Sandy-Remote
Watershed Analysis

Bureau of Land Management

Coos Bay District

Myrtlewood Resource Area

Second Iteration: September 1996

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Table of Contents

Section

Figures: Page

Tables: Page

Introduction

This report combines a first iteration watershed analysis for the Remote subwatershed and a second iteration of the Sandy Creek subwatershed into one document. The report is organized within reasonable conformity to the format described in the *Federal Guide for Watershed Analysis Ver. 2.2* (Guide). Prior analysis for this area include the Middle Fork Coquille Watershed Analysis (BLM 1994) and the Sandy Creek Watershed Analysis (BLM 1995). The Middle Fork Coquille was upgraded from an earlier watershed assessment with its focus towards a general overview of the 5th field watershed. Sandy Creek focused on the Sandy Creek subwatershed and information from that document was revised and rewritten for this document. The inclusion of the adjacent Remote subwatershed for this document was intended to broaden the analysis to allow management actions over a wider geographical area.

Watershed analysis is a major component of the ecosystem-based management strategy mapped out in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDI 1994). The stated purpose of watershed analysis is to develop and document a scientifically-based understanding of the ecological structures, functions, processes, and interactions occurring within a watershed, and to identify desired trends, conditions, data gaps, and restoration opportunities. The information, recommendations and data gaps documented in a watershed analysis can be used to help plan land management activities that are appropriate for the analysis area, support the NEPA process, and direct future data collection efforts. Watershed analysis was designed as an iterative process, with reports being revised as additional information becomes available.

The interdisciplinary team members initially convened to identify issues and questions pertinent to the analysis area, then worked independently to write sections covering the analysis questions for their respective fields of expertise. The team reconvened to synthesize the information into a cohesive watershed analysis report.

Location MAp

I. CHARACTERIZATION of the ANALYSIS AREA

LOCATION

The Sandy-Remote analysis area is composed of the Sandy Creek and Remote subwatersheds which lie within the Coquille River system. These subwatersheds are two of ten subwatersheds within the Middle Fork Coquille Analytical (fifth field) Watershed and comprise 17% of this area (Figure I-1).

The Coquille River is the largest system in the South Coast River Basin, draining 1058 square miles from the Coast Range and Siskiyou mountains, westward to the Pacific Ocean. The Middle Fork Coquille River is the largest and most eastern with a drainage area of about 305 mi^2 and mainstem length of about 40 miles. The confluence of the Middle Fork Coquille River is with the South Fork Coquille near Myrtle Point, Oregon.

The analysis area is located about 30 miles southeast of Coos Bay, Oregon, near the town of Remote. The area includes most of T.29 S., R.10 W. with minor portions of adjoining townships (Figure I-2) and is along both sides of the lower Middle Fork Coquille River between river mile 9 and 15.6. The Middle Fork Coquille is a 7th order stream, and has a gentle gradient of about 0.37% through the analysis area.

The Sandy Creek subwatershed is 12,740 acres and the Remote subwatershed is 11,242 acres for a total of 23,982 acres (37 sq. mi.). Tributary drainages include small frontals of the Middle Fork Coquille River, and larger 4-5th order streams. Drainage areas in descending order include Sandy, Middle Fork Coquille Frontals, Slide, Belieu, Anderson, Tanner and Frenchie Creeks (Figure I-3).

OWNERSHIP and LAND USE ALLOCATIONS

Of the 23,982 total acres in the analysis area, the Myrtlewood Resource Area of the Coos Bay District - BLM manages 10,365 acres (43%) of Federal land. The remaining 13,617 acres (57%) is privately owned.

All BLM lands are designated according to the categories set forth by the Record of Decision for the Coos Bay District Resource Management Plan (RMP) and the Record of Decision (ROD) for the *Supplemental Environmental Impact Statement on Management of Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (SEIS). The type and amount of each land use allocation is shown in Table I-1 and their respective location is shown on Figure I-4.

Loc map

Drainage map

Land Use

Table I-1: Ownership and Land Use Allocations in Sandy-Remote Analysis Area

Total Acres	23,982
Private	13,617
BLM	10,365
GFMA (General Forest Management Areas)	6,967
LSR/MMR (late-Successional Reserves)	3,399
Connectivity	0
Riparian Reserves-all land allocations (estimate)	5,153
Total Reserves[1]	7,274

[1]Includes LSR, MMR, TPCC withdrawn lands, and Riparian Reserves (GFMA only)

GEOLOGY

The Sandy-Remote analysis area is within the Coast Range Physiographic Province and has one inclusion from the Klamath Mountain Physiographic Province(Belieu Creek drainage and the southwestern portion of the Middle Fork Coquille Frontal)(Figure I-3). The Coast Range Province actually dips south of Highway 42 to slightly below the city of Powers, OR. (Baldwin 1973

Geologists speculate that between 45 and 60 million years ago the Coast Range Physiographic Province was part of a large, partially enclosed basin called a geosyncline. Vast amounts of submarine basalt flows, breccias, and tufaceous sediments were deposited in this geosyncline during past volcanic activity and subsequent surface erosion during tetonic uplifting. These flows and deep water sediments constitute the Roseburg, Lookingglass, Flournoy, and Tyee Formations (Figure I-5).

The Klamath Mountain Physiographic Province borders the Coast Range Province on the south and extends into California as far south as San Francisco. It is the most geologically complex province in southwestern Oregon. It is comprised of very old (450 million yrs.) sedimentary and volcanic rocks, locally metamorphosed (altered by heat and pressure), and with intrusions of granite and serpentine. This portion of the analysis area contains the Otter Point formation and soils derived from serpentinite parent materials (Figure I-5).

There are five geologic formations and three members of one of those formations in addition to other deposits and outcroppings within the analysis area. They are from the oldest formation to the youngest: Otter Point, Roseburg, Lookingglass, Flournoy, and Tyee Formations. The base rock is weakly resistant to erosion. Small deposits of quaternary alluvial material fill the main Sandy Creek and a portion of the main Coquille River stream valleys. Faults within the analysis area are predominately found in the Otter Point Formation. One large apparent fault lies in a Northeasterly direction from Belieu Creek on up into the middle of the Upper Sandy Creek drainage.

Geology Map

Soils map

soil legend

The steep uplifted and exposed face of these younger formations in the Slide and Sandy Creek drainages are unique to the general area. Some portions of this uplifted band extend south to the Eden Ridge portion of the South Fork Coquille drainage and to the North in the East and Middle Fork of the Coquille river systems. The steep face provides many rock outcroppings, vertical cliffs and talus slopes on ridges between the following drainages: Frenchie and Sandy, Slide and Anderson, Rock and Sandy and Slide and Bone Mountain.

SOILS

According to the Soil Survey of Coos County, OR. (USDA 1989), there are four major groupings of soil types (Figure I-6). The Preacher-Bohannon and Digger-Preacher-Remote associations are deep and moderately deep, moderately steep to very steep, gravelly and loamy soils that formed in colluvium and residuum derived from sedimentary rock. The Serpentano-Digger are soils that are moderately deep to deep, moderately steep to very steep, gravelly and loamy soils that formed in colluvium and residuum derived from metamorphoric and sedimentary rock. The Umpcoos-Rock outcrop-Digger associations are soils that are rock outcroppings or moderately deep to shallow, very steep, gravelly and loamy soils that formed in colluvium derived from sedimentary rock. These soils are representative of eastern part of the Upper Middle Fork of the Coquille River. The exception is the Serpentano soils of Belieu Creek and the Lower Middle Fork Coquille Frontal drainages, these soils are more characteristic of the Klamath Mountain Province that is found south of Powers, OR on the Siskiyou National Forest.

CLIMATE

Annual precipitation occurs mostly as rainfall, ranging from 55 inches in the low elevations and river valleys along the Middle Fork Coquille, to more than 70 inches in the upper areas of Sandy Creek near 2900 feet (OSU 1993). Precipitation varies strongly with elevation, with greater amounts in the higher portions of the drainage. Aspect and drainage orientation to prevailing winter Southwest winds also influence precipitation amounts. The analysis area seems to occupy a slight rain shadow behind the Siskiyou mountains from the Southwest trending winter storms, thus precipitation is lower than elsewhere in the Coast Range. Cool, moist air masses lifting over the Coast Range can produce snow over 1500-1800' elevations. These are intermittent snow packs, usually persisting on the ground for only a few weeks, and sometimes melting quickly with warm winds and rain. Extra water storage as snow water equivalent can elevate flood waters.

Approximately 90% of the average annual precipitation occurs between October and April, with 50% occurring during November-January. Although heavy rainfall occurs with winter storms, most of the precipitation is low intensity, and commonly occurs as "drizzle". Precipitation during the summer months is only about 10% of the annual average. Average dry season precipitation, from May through September varies from 7 inches for most of the Remote subwatershed to 9 inches at the northern higher elevations of the Sandy Creek subwatershed (OSU 1982).

Maximum precipitation periods are responsible for high runoff, including flooding, watershed erosion, slides, and debris torrents - but occur on an infrequent basis. High precipitation with the melt of existing shallow snow packs can worsen flooding. Analysis from area NOAA

Cooperative Weather Stations, damaging storms have a return frequency of 5 years or more, and could be expected to have daily precipitation of at least four inches. Cumulative precipitation of 9 inches or more in several days, has been correlated with a higher incidence of landslides and torrents (see Section III.1- Erosion Processes).

Temperatures are generally quite mild with maximum temperatures seldom exceed the low 90's, nor fall much below freezing. Sustained hourly wind speeds on Signal Tree, a high point, about five miles East of the analysis area have not exceeded 48 mph in the last five years, with a gust speed of 72mph (does not include the December 1995 storm). The prevailing wind direction is South/Southwest.

WATERSHED GEOMORPHOLOGY

The Coast Range is a north-south trending anticline, dissected by east-west stream systems. The Middle Fork Coquille River, is entrenched in the landscape and lies generally at elevations between 100-220 feet through the analysis area. The river gradient is very low, except near the eastern end of the analysis area where the stream profile sharply steepens. Contrarily, the tributary drainages consist of narrow canyons and much steeper channel gradients. Selected watershed characteristics and bankfull flows for the Sandy-Remote drainages are shown in Table I-2.

The drainage pattern is dendritic with a high drainage density of more than 6.25 mi/mi^2. About 283 miles of streams are found of which first and second order streams comprise 79% of the total drainage density (Table I-3). These are generally steep headwaters channels draining small catchments. Many of the first order streams and some of the second order streams become intermittent by late summer. The remaining 21% percent of the stream miles are mostly perennial.

Table I-2. Drainage Areas of Tributary Streams

Watershed Drainage	Acres	Mi.^{2}	*Mainstream Length, Mi.	Relief , Ft.	Bankfull Flow, CFS
Anderson Creek	1,226	1.9	1.69	500	92
Belieu Creek	1,614	2.5	3.05	820	120
Frenchie Creek	816	1.3	1.79	1100	63
Sandy Creek	12,658	19.8	9.84	1470	954
Slide Creek	2,931	4.6	2.57	620	222
Tanner Creek	1,014	1.6	1.98	1220	77
Middle Fork Frontals	3,277	5.8	6.19	120	280
Total	23,982	37.5			1808

Table I-3. Miles of stream by stream order for the Sandy/Remote watershed.

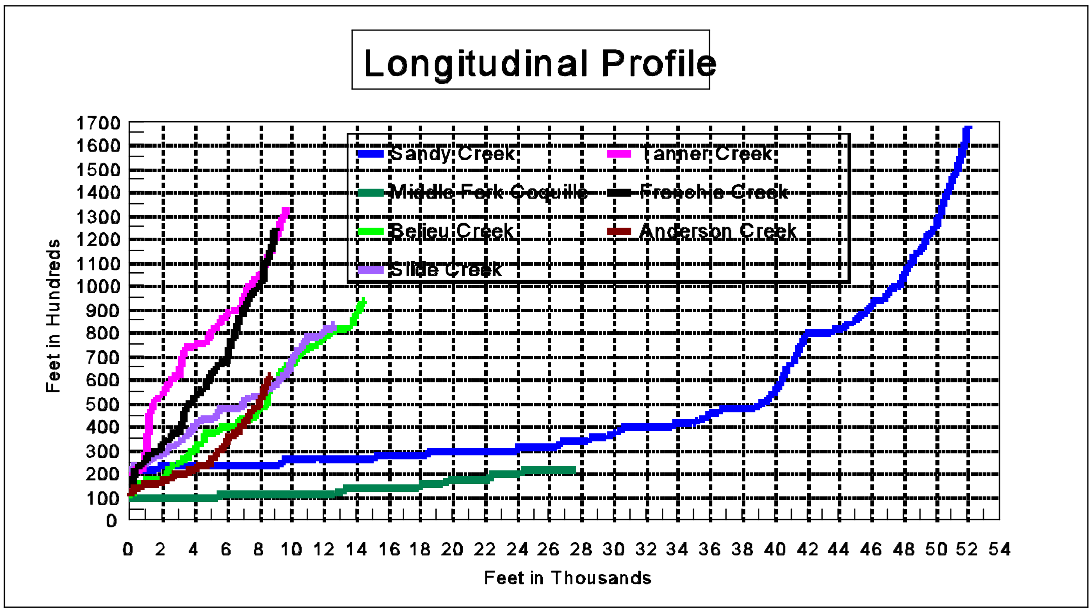
Drainage	Miles of Stream by Stream Order[1]							
	1	2	3	4	5	6	7	Total
Anderson Creek	3.0	3.1	1.3	0.7	0	0	0	13.1
Belieu Creek	12.2	3.9	0.8	2.8	0	0	0	19.7
Frenchie Creek	7.9	3.0	0.4	1.6	0	0	0	12.9
Sandy Creek	65.4	37.9	15.0	6.6	8.5	0	0	133.3
Slide Creek	24.8	7.3	5.3	1.2	1.7	0	0	40.3
Tanner Creek	6.6	4.2	1.8	1.6	0	0	0	14.2
Middle Fork Coquille Frontal	28.1	10.9	3.7	0.3	0	0	6.2	49.2
Total (%)	**153.0** 54%	**70.3** 25%	**28.4** 10%	**14.7** 5%	**10.3** 4%	**0** 0%	**6.2** 2%	**282.7**
Drainage Density, mi/mi^2	**3.4**	**1.6**	**0.6**	**0.3**	**0.2**	**0**	**0.1**	**6.3**

[1] Relative position of streams, where all exterior links are order 1, and preceding downstream, the confluence of two like orders result in existing stream order +1. The junction of two different orders retains the higher order, and the main stream always has the highest order (Strahler 1957).

Hillshade map

Tributary streams drain rugged mountainous land forms, from near sea level to 2800 feet at the northern end of Sandy Creek and generally start below steeply sloping headwalls (Figure I-7). Longitudinal profiles of streams are useful to compare morphology between stream reaches or from one stream to another. Frenchie Creek and Tanner Creek have the highest average gradients of 11.6% and 11.7 % respectively (Figure I-8). These are high energy erosional streams with a high capacity to move water and sediment. Anderson, Belieu, Slide and the upper one half of Sandy Creek are moderate to steep gradient streams and have average gradients of 5.6%, 5.1%, 4.6% and 5.4%, respectfully. These are moderate to high energy erosional streams, with a moderate to high capacity to move water and sediment. The Middle Fork Coquille River, through the analysis area, and the lower one half of Sandy Creek are low gradient streams with average gradients of 0.37% and 0.30%. These are low energy depositional streams.

Figure I-8. Stream Profiles in the Sandy-Remote Analysis Area

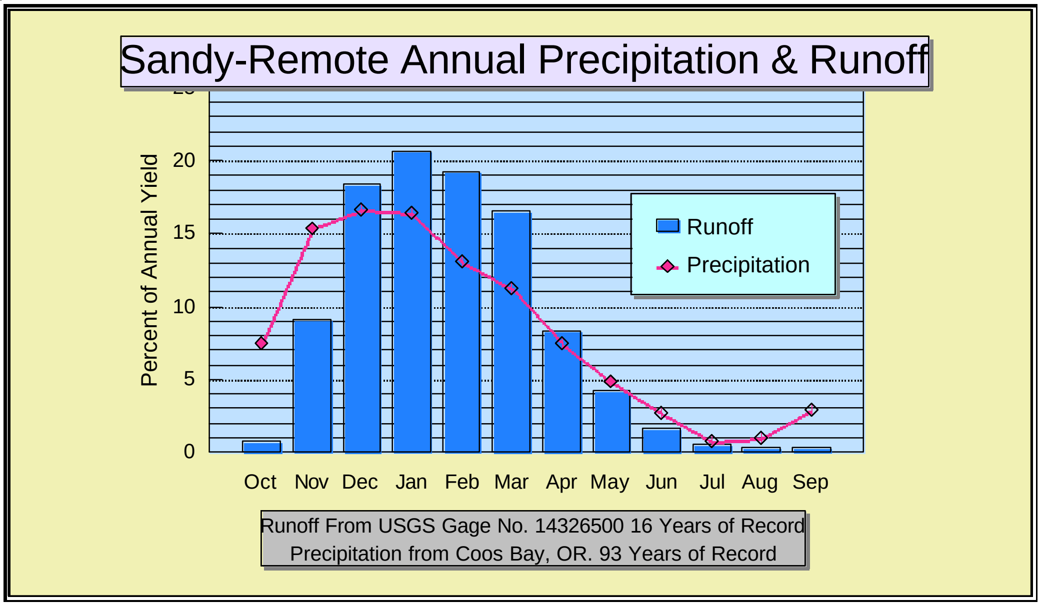


HYDROLOGY

Forest hydrology is the study of the occurrence, movement, and distribution of water across forested watersheds, and how they are affected by soils, geology, land form, vegetation and climate. The principal driver of hydrology is precipitation as rain of which a high percentage ends up as runoff (Figure I-9) Precipitation events interact with the land form, soils, geology, and vegetation. This interaction has an effect on hydrological characteristics such as, floods, frequent discharge, low flow, and distribution of flow.

Except for direct interception into streams, nearly all of the runoff occurs by infiltration into the soils and subsequent subsurface routing to streams due to the low water storage capacity of the shallow and coarse textured soils, and impermeable underlying bedrock that does not readily transmit water. Overland flow is seldom observed in the Coastal forests because infiltration capacities are in excess of 3 inches per hour, which is much higher than the most intense hourly storm of 4 inches in 6 hours (NOAA 1973). Surface flow can runoff from compacted sites, such as roads and landings, and can increase quickflow from rainstorms.

Figure I-9 Monthly precipitation and Runoff Distribution



The stream network expands during storms, especially over several days to weeks, as more of the watershed soils become saturated, and live flow again reappears in low order intermittent channels. By examination of available precipitation and stream flow records, it is estimated that total runoff is about 65% of annual precipitation. The remaining losses include soil recharge, transpiration from the dense vegetation, and evaporation. Steeply inclined drainages, little groundwater storage, and steep stream gradients cause quick hydrograph response and flashy flow after the onset of rain. Stream hydrographs for an individual storm emphasize this short lag time with a steep rising curve, but a more moderate recession.

VEGETATION

Most of the Sandy-Remote analysis area is comprised of the Port-Orford-cedar (*Chaemacyparis lawsoniana*) variant of the western hemlock (*Tsuga heterophylla*) zone (Franklin and Dryness 1973). An isolated area of White oak (*Quercus garryana)* woodland is found on private ownership near the west end of the analysis area adjacent to Highway 42 on a southern exposure. Approximately 72% of the vegetation has been altered through logging or agricultural practices. Some of the oldest forest stands within the Middle Fork Coquille watershed are located within the upper reaches of Sandy Creek and adjacent to the Middle Fork Coquille on BLM managed lands. Data on private lands, available from aerial photography, estimates that 97% of the private lands have been harvested since the 1940s.

FOI map

These lands were generally reforested and are covered with Douglas-fir stands 60 years old or less and are of varying density.

GIS data, describing forest age class, size, and density (Forest Operations Inventory, FOI), is available for BLM lands. While age class information for older stands (>80 years or so) is often inaccurate and one age class may often encompass stands of varying ages and densities, FOI offers the best available picture of forest condition. FOI information for young stands, particularly those < 40 years old, is far more accurate. Table I-4 summarizes FOI forest age class information for BLM-administered land in the analysis area. Locations of differing age class can be located on Figure I-10.

Table I-4. Age Class Distribution on BLM Lands

Forest Age Class	Acres	Percentage
0 - 20	2657	26%
21 - 40	1237	12%
41 - 80	486	5%
81 - 120	2483	24%
121 - 160	3131	30%
161 - 200	5	<1%
200 +	337	3%
Total	10366	100%

WATER QUALITY

The Coquille River has been listed as “water quality limited” in Oregon's 1994 Water Quality Status Assessment (305b) Report. A Total Maximum Daily Load (TMDL) has also been established by ODEQ. “Water quality limited” means that treatment techniques are being used, but frequent accedences of ODEQ water quality standards still occur. TMDL is the total amount of pollutant from all sources that can enter a water body without exceeding water quality standards. Low levels of dissolved oxygen during the summer months (ODEQ 1994a) is the primary water quality parameter of concern for which the Coquille River TMDL was established. Fecal coliform also exceeds standards in some river segments below the confluence of the Middle Fork Coquille with the South Fork Coquille. Additional concerns include temperature, nutrients, and sedimentation.

The Middle Fork Coquille River is also listed on the revised water quality limited 303(d) list from the mouth to upper Rock Creek with regard to; dissolved oxygen for salmonid spawning during October-April; temperature during summer; and Fecal Coliform for water contact-recreation during Fall-Spring (ODEQ 1996a). Streams are listed on the 303(d) list when monitoring data indicates stream reaches are not meeting State water quality standards. Water quality limited 303(d) streams cannot be removed from ODEQ's listing, until a TMDL is established or a TMDL equivalent watershed management plan is approved. Such management plans will take a basin wide approach with all landowners as participants to restore water quality in affected reaches.

SPECIES AND HABITATS

Aquatic

The following native fish species currently use the Sandy-Remote analysis area during all or part of their respective life cycles (as verified during spawning ground/habitat surveys, electrofishing, or anecdotal accounts). Although population sizes and relative distributions have changed through history, there have been no known recent extinctions. Populations of exotic fish species may be present in privately owned ponds, but were not evaluated in this analysis.

Common Name	Scientific Name	Population Trend	Status[1]
Chinook salmon (fall)	*Oncorhynchus tshawytscha*	stable	-
Coast range sculpin	*Cottus aleuticus*	unknown	-
Coho salmon	*Oncorhynchus kisutch*	decreasing	PF; at risk
Cutthroat trout	*Oncorhynchus clarkii*	decreasing	at risk
Largescale sucker	*Catastomus macrocheilus*	unknown	-
Pacific lamprey	*Lampetra tridentata*	decreasing	SSV
Prickly sculpin	*Cottus asper*	unknown	-
Reticulate sculpin	*Cottus perplexis*	unknown	-
Speckled dace	*Rhynichthys osculus*	increasing	-
Steelhead (winter)	*Oncorhynchus mykiss*	decreasing	-
Threespine stickleback	*Gasterosteus aculeatus*	unknown	-
Western brook lamprey	*Lampetra richardsoni*	unknown	-

[1] Status = Federally Proposed T/E (PF); State Special Status - sensitive vulnerable (SSV); At risk of extinction according to Nehlsen et. al. 1991 (at risk).

The fish distribution map (Figure I-11) is a composite of stream classification maps and records obtained from BLM (GIS database and stream inventory files), Oregon Department of Fish and Wildlife (ODFW), and Oregon Department of Forestry (ODF). Fish distribution indicates the furthest logical upstream endpoint noted among source materials. In some cases, the upstream limit of fish was verified with electrofishing done in accordance with fish presence survey protocol (ODFW and ODF 1995). In cases where surveys were unavailable, distribution was estimated from studies of topographic maps and was based primarily on stream gradient limitations (resident trout was assumed to end where gradient was equal to or greater than 20% for a 1,000 ft. distance).

Fish limits

Table I-5. Estimated miles of fish bearing and non-fish bearing waters in the Sandy/Remote watershed.

Drainage	Anadromous & Resident	Resident Only	Non-fish bearing	Total
Anderson Creek	1.0	1.1	11.0	13.1
Belieu Creek	0	3.2	16.5	19.7
Frenchie Creek	0	1.4	11.5	12.9
Sandy Creek	10.0	8.0	115.1	133.1
Slide Creek	0.6	2.5	37.2	40.3
Tanner Creek	0	1.6	12.6	14.2
Middle Fork Coquille (mainstem & frontals)	6.2	0	43.0	49.2
Total	17.8	17.8	246.9	282.5

Two species of freshwater bivalves (mollusks), *Gonidea angulata* and *Margaritifera falcata*, are present within the mainstem Middle Fork Coquille River and in the lower reaches of Sandy Creek. These species are probably less abundant or less widely distributed than historically due to depletion of deep substrates in these areas.

Riparian

Riparian areas are among the most heavily used habitats for most wildlife species occurring in the forest lands of western Oregon, because they provide requirements vital to these animals for some aspect of their lives; i.e., food, water and shelter. Brown, et al., (1985) found that of the 414 wildlife species analyzed (in western Oregon and Washington), 359 used riparian or wetland habitats. In addition, several species of concern occur in spring and seep habitats. Riparian areas are sometimes used as travel corridors, and may be used for species dispersal. These areas also provide nesting and perching sites, particularly for those species that use the aquatic invertebrate populations as a prey base.

Terrestrial

The analysis area contains numerous ecologically and economically important wildlife species. Table C-1 Appendix C contains a list of all vertebrate wildlife species known or suspected to occur. Of these, there are 36 wildlife species or species groups of special management concern because they were not addressed in regional planning efforts (USDI 1995) as further site-specific analysis was needed, or special local concern existed Table C-2 Appendix C. These species of concern[1] rely on key habitats or habitat features such as complex forest structure, late-

[1]The phrase “species of concern” is used to refer to the group of species for which special management concern exists in the analysis area (consistent with the use in WA Guide Ver 2.2) and is not to be confused with the species of concern list maintained by the U.S. Fish and Wildlife Service which is roughly analogous to the former Federal Candidate 2 species list.

successional forests, snags and down logs, and rocky habitats and are further influenced by the pattern of these habitats on the landscape. Because of the unique geologic features, rocky habitats are more common in the analysis area than in most of the district. A rock band encircles the headwaters of Sandy and Slide creeks and offers a variety of cliff, rock, and talus habitats. Several species of wildlife including raptors, bats, wood rats, amphibians, and invertebrates as well as several plant species occur primarily in these rocky habitats.

The location of the analysis area, land ownership patterns, and the land use allocations help define its ecological role in the larger landscape. Key ecological functions include; facilitating dispersal of wildlife between the LSRs to the north and south of the analysis area; providing refuge areas for late-successional species and habitat connections to other or future habitats to support recolonization of adjacent areas; maintaining a forest matrix which retains important habitat features such as snags, down logs, and a complex forest structure conducive to wildlife movements; and providing habitat for early and mid-successional species.

HUMAN USES

The Sandy-Remote analysis area has been the location of both prehistoric and historic cultural activities. As in historic times, the focus of prehistoric activities probably was the Middle Fork Coquille River, which bisects the analysis area. The river provided an important transportation link between the southern Oregon Coast and Camas Valley, both vital areas for resource acquisition. The river and tributary streams provided their own suite of fish and shellfish resources, as well as allowing access to gathering and hunting areas.

II. ISSUES AND KEY QUESTIONS

ISSUES

Two main issues affecting management have initiated the need for and the focus of the watershed analysis in the Sandy-Remote drainage. The first issue is to identify potential timber harvest areas within the GFMA land use designation that could contribute to the District's Probable Sale Quantity (PSQ) for fiscal years 1997 and 1998. The Coos Bay Resource Management Plan requires that harvest areas be identified through the watershed analysis process. Once identified, these potential harvest areas are brought forth into the timber sale planning / NEPA process to verify the operational viability and assess the direct, indirect, and cumulative environmental impacts.

The second issue is to determine the overall health of the watershed as it relates to which restoration opportunities could be enacted to improve key ecosystem components such as; water quality, fish spawning & rearing habitat, or wildlife habitat. Recommended restoration activities would be brought forth into the 'Jobs-in-the-Woods' program or other funding opportunities and similarly evaluated for viability and environmental impacts (NEPA).

KEY QUESTIONS

The Guide recommends development of ‘key questions’ which address the main issues, focus on ecosystem elements as they relate to management actions, promote synthesis/interpretation of information, and are to be answered by the analysis. They are:

1. Where could timber be harvested from the analysis area to help meet the District's commitment to PSQ?
2. What immediate opportunities and needs for restoration exist in the analysis area?
3. What criteria should be used to delineate final Riparian Reserves boundaries for intermittent streams?

ANALYSIS QUESTIONS

In addition, each section contains a series of analysis questions. These were developed by the team and are designed to become progressively more refined in order to answer the key questions. The Guide also contains a series of so called ‘core questions’ to be addressed. Answers to these core questions are contained within the team’s analysis questions or were not found to be relevant to this analysis.

III.1 CORE TOPIC - EROSION PROCESSES

EROSION PROCESSES

<u>Analysis Questions:</u>

What are the dominant historical and current erosion processes within the watershed (e.g., surface erosion process, mass wasting)? Where have they occurred or are they likely to occur?

What are the <u>indices</u> of landsliding and surface erosion within the analysis area?

How and where have <u>management activities</u> played a role in producing landslides? How have they affected sediment routing in the analysis area?

What are the influences and relationships between erosion processes and other ecosystem processes (e.g., vegetation, woody debris recruitment, aquatic habitat, etc.)? How have management activities affected these relationships?

What are the <u>management objectives</u> for rates of landslides?

There are two dominant and three minor erosional processes within the analysis area. In order of importance these are: mass wasting (landslides), rotational slumps, stream bank failures, channel incision, and surface erosion. Mass wasting is the most important process and occurs most frequently. Three different types of mas wasting noted during analysis are: debris torrents, debris avalanches, and shallow rapid debris failures. A debris torrent is the rapid downslope movement of large amounts of soil and woody debris within a stream channel under the influence of water and is usually a liquid flowing mass that can travel considerable distances downstream. A debris avalanche is a mass of soil that moves downhill under the influence of gravity and often results from under mining of the toe of the slope or over steepening the slope past the natural angle of repose. Shallow rapid debris failures are those slides that move the top few feet of soil downslope short distances and contribute fine sediment to the stream channel.

REFERENCE CONDITION

<u>Mass Wasting</u>
Prior to harvest and road building activities, the important erosional processes that occurred were large scale landslides and rotational slumps as viewed on 1943 and 1976 aerial photos. The eastern part of the analysis area is geologically younger and steeper, whereas the western portion of the analysis area is very old (nearly 9 times older) and has slopes about half as steep as to the east. One large debris torrent (Sec 1, T. 29 S., R. 10 W., headwaters to Sandy Creek) and one rotational slump (Sec 35, T. 29 S., R. 10 W., west of the Kinchloe quarry on the Middle Fork Coquille River), are slides characteristic of the underlying geologies. Both of these mass movement events removed large amounts of soil and woody material and routed it to lower gradient portions of the respective streams. No historic rates can be determined for these types of

landslides, although researchers speculate they were infrequent (Ketcheson 1978).

Debris torrents were present prior to human influences. These mass wasting events were infrequent but contributed many important structural components to the lower river system. Large wood and boulders carried by debris torrents are key structural components that build lasting debris dams on lower gradient stream segments. These structures create aquatic habitat, act as sediment filters, and store water throughout the system for long term release later in the summer. The infrequent nature of these events can be accelerated by large scale removal of vegetation from the landscape such as the wildfire that occurred about 1860. Smaller fires along the Middle Fork Coquille River could also precipitate debris torrents.

Surface erosion

Though no historic surface erosion rate is known for the analysis area, erosion is influenced by the vegetational component on the land surface. The area is known to have had large fires that would have produced large quantities of sediment from surface erosion processes. It is assumed that the rate of surface erosion would have alternated from periods of high to low based on a small number of episodic events (i.e., fire) spread over a long time span.

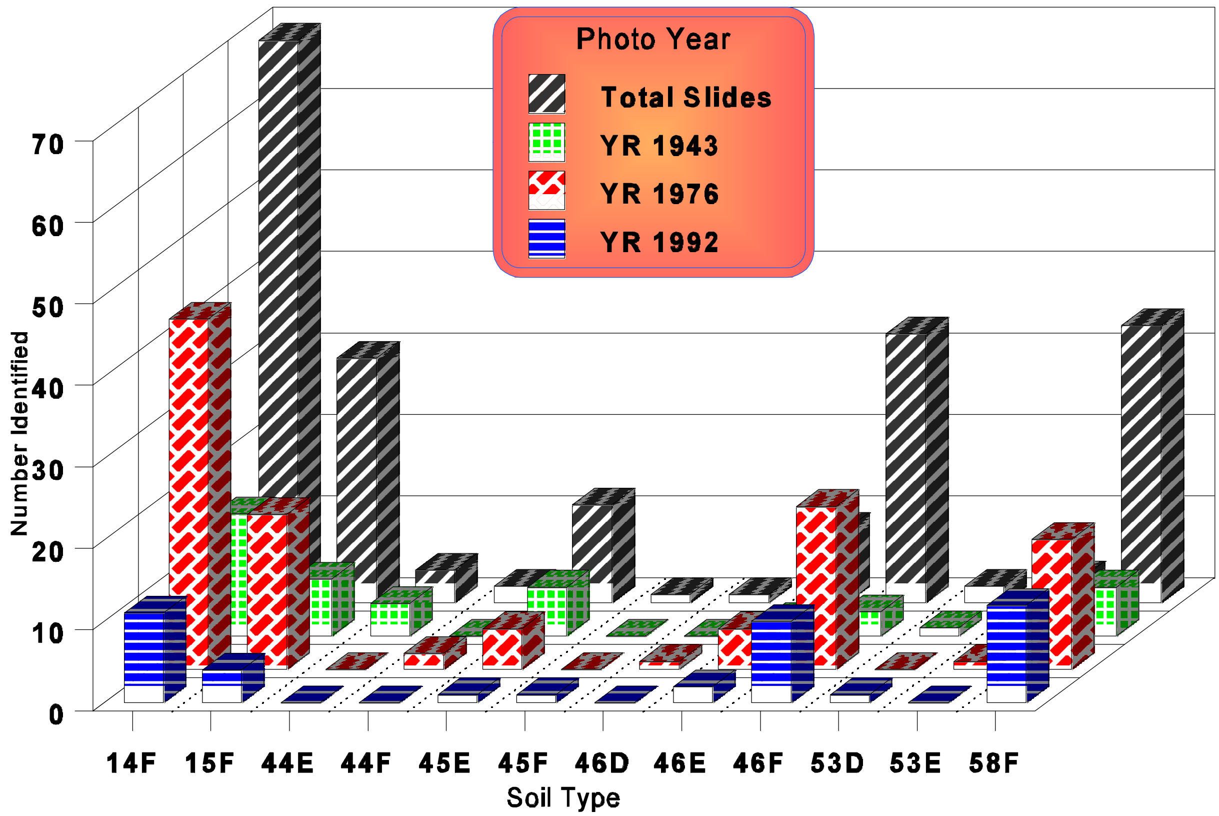
CURRENT CONDITION

Mass Wasting

Landslides visible on aerial photos (taken in 1943, 1976, and 1992) were used to determine the type and rate of landsliding. Prior analysis during the Sandy Creek Watershed Analysis (BLM 1995) pointed to these years as the most representative. Underlying soil type, geologic formation, and land management activity thought to precipitate the slide were identified for each occurrence (Figures III.1-1, III.1-2, and III.1-3 respectfully).

Using aerial photo interpretation, the number of slides counted between photo years 1943 and 1992 yielded a rate of three slides per year. It also revealed that most of the slides were shallow rapid debris failures and debris avalanches. These types of slides were strongly correlated with management activities such as timber harvest and road construction. A risk in doing a landslide inventory from aerial photographs is that the method underestimates landslide rates for the undisturbed forests because shadows caused by steep narrow ridges, and tall, dense forest vegetation make failures within forest areas difficult to identify on aerial photos (Skaugset 1992). During a field review of riparian areas, it was noted that stream bank failures and channel incision also have been occurring.

Figure III.1-1. Landslides observed on 1943, 1976, and 1992 aerial photos, classified by soil type.



Shallow rapid debris slides and debris avalanches are currently the most common in the watershed. Rotational slumps and earth creep types are also evident, particularly in Belieu Creek and on the western end of the Coquille River frontal drainages. These slides currently do not deliver the quantities of large wood and boulders that, historically, were delivered from these types of slides. The soil component is still being delivered to the stream system; whether the amount is more or less than historical levels are unknown.

Figure III.1-2 Landslides on Geological Formations

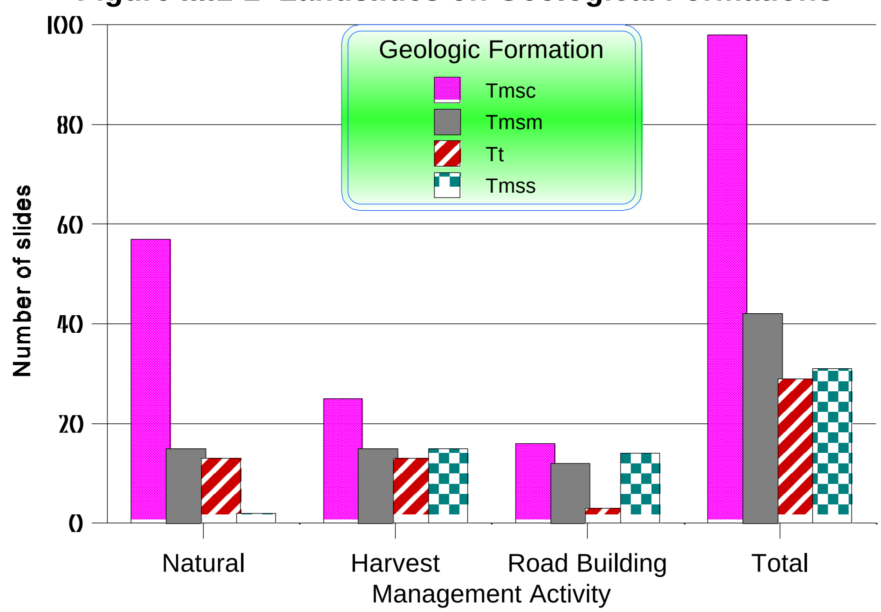
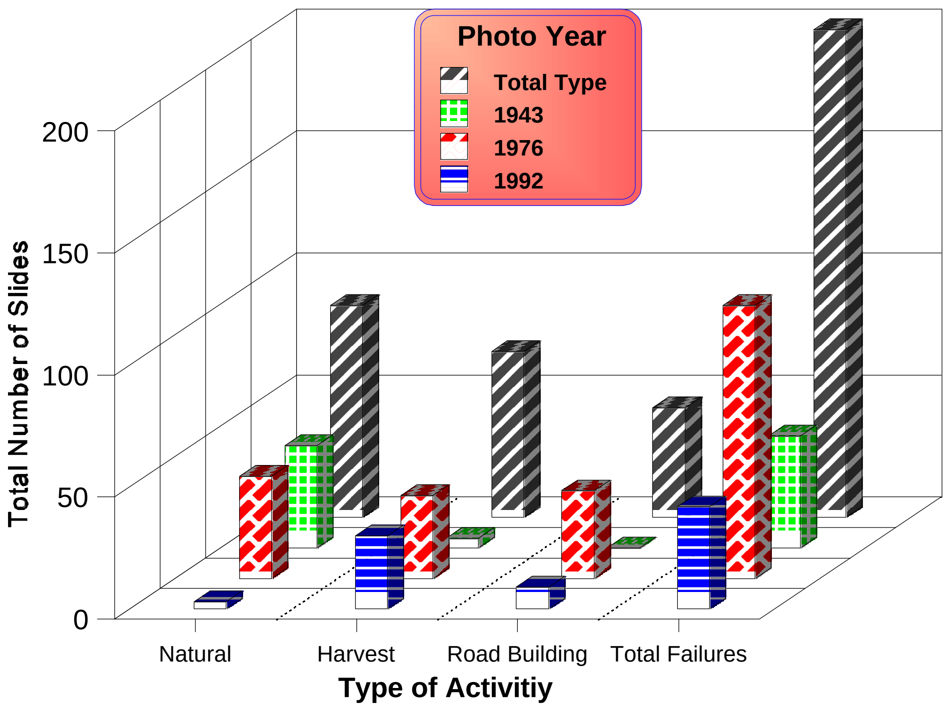


Figure III.1-3. Landslides observed on 1943, 1976, and 1992 aerial photos, classified by Management Activity.



The 1992 aerial photographs revealed that a large debris torrent occurred on tributary B of Sandy Creek (Figure III.6-2). This event started within a 62-acre clearcut in T.29 S, R.10 W, Sec. 1 SE¼ (Timber Sale No.84-31) and occurred shortly after the unit was burned in 1986. The results of the debris torrent were areas of deep channel incision, export of large amounts of sediment, and displacement of large woody debris out of the stream channel. Approximately one mile downstream from where the debris torrent started, a second debris torrent occurred at roughly the same time. This second debris torrent originated at a clearcut in T.29 S, R.10 W, Sec. 12 in tributary Z, and flowed into tributary B. These debris torrents cleared a wide swath of riparian vegetation from their points of origin to the confluence of tributary B with Sandy Creek. Apparently, much of the debris torrents' energy dissipated by the time it reached Sandy Creek, as the bridge on Road No. 29-10-11.2 was not damaged.

Surface Erosion

Surface erosion in a forested environment is not a major contributor of sediment. Soil erosion rates were modeled, but not validated, using the Revised Soil Loss Equation in the Grid sub-program of ARC/INFO. According to the model this watershed can expect to produce .01 to .1 tons/ac./yr. from most of the land surfaces. Higher rates up to 10 to 12 tons/ac./yr. occur at the headwaters of the Sandy Creek drainage on the very steep cliffs. The Soil Conservation Service defines soil loss as the amount of soil that can be lost without incurring a loss in production and defines a value in tons/acre/year. For most of the soil types within the analysis area the acceptable soil loss from surface erosion is 4 to 5 tons/ac./yr. However, some shallow soils (those less than 20 inches in depth) can only sustain a loss of 1 ton/ac./yr. (USDA 1989). According to Swanson et. al. 1989, these soil loss tolerances may not apply to forest ecosystems.

Since 1943, timber harvest, road construction, and fires have been the primary contributors to surface erosion. Timber removal on private ground has made extensive use of ground-based systems and have left skid trails in a non-vegetated condition. These types of source areas will allow the fine sediment portion of the soil to be moved into the stream system.

SYNTHESIS & INTERPRETATION

Mass Wasting

The trend for the analysis area is for private lands to be managed under a short (50 to 60 year) timber harvest rotation, and for GFMA lands to be managed with a minimum 60 year rotation. Connectivity lands have a longer minimum harvest rotation age (150 years), while reserve areas (Riparian Reserves, LSRs) have no rotation age. Lands which are managed under the shorter rotations will likely incur a higher than historic frequency of shallow rapid debris slides and debris avalanches, whereas, lands managed under longer rotations (Connectivity Areas and Reserves) should return to similar level of historic landslide rates (lower frequency of debris avalanches/debris torrents).

Indices

To determine the critical and sensitive land forms in the analysis area, several analytical tools were employed. Land stability was modeled with the Infinite Slope Equation and a predicted Factor of Safety less than 2.0 was used to determine those areas (Figure III.8-2, pg.133). These areas are predicted to fail under a set of worst case circumstances outlined in Section III.8 - Riparian Reserve Evaluation. Results indicate that landslide failures are predicted in draws and midslope areas where slope angles exceed 65%, with no distinct concentration in any one drainage.

A visual comparison between the predicted areas of failure and actual slides reveal a good fit in steep portions of the watershed, but over predicted the number of failures in the draws and on some soil types. The model is incapable of determining influences from road building and cannot account for long term climate changes such as drought. A comparison between our Timber Production Capability Classification (TPCC) (USDI 1986) (Figure III.1-4), and the Infinite Slope Equation model shows a poor fit between the predicted areas of failure based on the model, and TPCC withdrawn lands, fragile gradient lands, others considered high risk. The TPCC rating is based on the ability of the land to produce a given amount of timber from the landscape with operational management activities and was not intended to predict landslide areas.

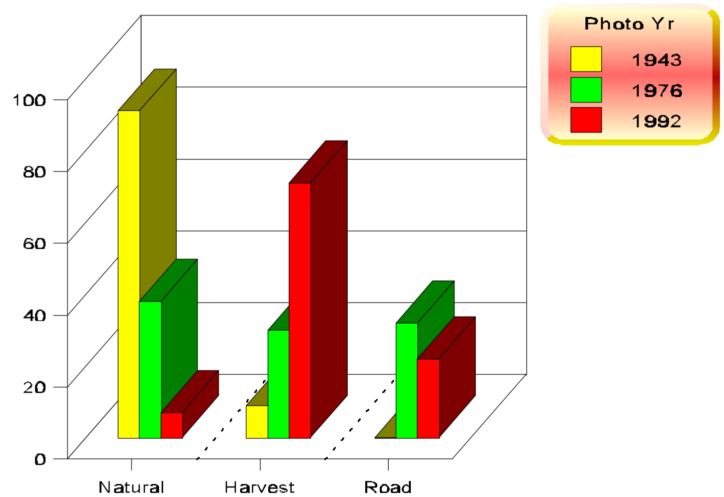
Management Activities

From the analysis of the data, a pattern emerges that reflects the landscape response to management activities. In 1943 there were 46 total slides (Figures III-1,2,&3). As our management activities increased on the landscape so did the number of slides as evidenced by the 112 slides in 1976. However, the pattern does not hold steady in 1992 when management activities covered nearly the entire analysis area (Table III-5.1). The nearly three fold increases in landslide numbers is due to the type of techniques commonly used and the location of the roads. Harvesting and road building techniques changed in the mid-70s to early 80s and the

TPCC map

reduction in slides may be due to that change.

Figure III.1-5 **Percent of Landslides by Management Activity**



The percentage of management activity slides as related to the total number of slides in any given photo year is represented in Fig. III.1-5. In 1943 the percentage is low for management related activities and by 1992 makes up the majority of the total. This may be a reflection of the level of activities or the inability to separate a natural slide event from one where activities have occurred in the past. It is assumed in the inventory that if a slide occurs on managed lands it is related to that activity and this may not necessarily be so.

The high incidence of slides observed in 1976 photos could have been influenced by factors other than management practices alone. During the years from 1943 to 1976 the watershed experienced the 1964 flood as well as an above average wet periods in 1955, 1971 and 1974. The high number of slides identified in 1976 could be a reflection of the amount of water delivered during that time frame. Although these 112 slides were 56% of the total observed in the three photo years (Figures III.1,2,&3), dividing the number of years (33) into the number of slides results in only 3.4 slides per year, only slightly higher than average. It was observed that most failures in harvest units did appear to reach the channels, but no attempt was made to calculate cubic yards of sediment delivered to the channel.

The number of slides attributed to harvesting and road building was reduced after 1976. The rate between 1976 and 1992 is 2.6 slides per year. However, this may be due to the low rainfall experienced within the watershed during the 1980's, or perhaps, it is the reflection of the change in logging techniques and road building practices adopted in the mid to late 1970’s. Early road construction involved low engineering standards, often pushing excess dirt over the side of the road (sidecasting) and placing logs in streams for stream crossings. Road construction standards for BLM roads changed significantly in the late 1970's when sidecasting on steep slopes and construction over unstable areas were severely restricted.

Landslides were found to occur more frequently on four soil types (14F, 15F, 46F, and 58F) (Figure III.1-1, and Table III.1-1). Nearly 90% of all the failures occurred on these soil types which make up only 52% of the Sandy-Remote watershed. Most slides are on steep soils that are greater than 50% but, occurrence is more likely on slopes >65%. The soil types most sensitive to landsliding are the 14F and 58F. Their slide rates are double what would be expected, based on land surface.

Rotational failures are more important in the western end of the analysis area on the older geological formations. Even through the slopes are not steep there is a risk of land failure in these areas. Furthermore no apparent correlation between Geologic formation and incidence of landsliding was noted (Figure III.1-2 and Table III.1-2).

Table III.1-1 Comparison of Percent of Landslides by Percent of Soil Type.

Soil Type	Percent of Land Base	Percent of Slides
14F	16	35
15F	12	15
46F	15	17
58F	8	17

Table III.1-2 Comparison of Percent of Landslides by Percent of Geologic Formation.

Geologic Formation	Percent of Land Base	Percent of Land Base
Tyee (Ty)	19	15
Flournoy (Tmss)	11	15
Roseburg (Tmsm)	23	21
Looking Glass (Tmsc)	48	49

<u>Surface Erosion</u>

Both natural disturbances (fire, windstorms, floods, landslides) and management disturbances (harvest, roads) have resulted in unvegetated areas that are prone to pulses of sediment delivery to streams. Although sediment delivery from surface erosion has not been quantified for the watershed, it is assumed that the elevated rate is primarily a result of management. Dirt spur roads open to traffic on even moderate (20-30%) side slopes, and uncontrolled flow of water on road surfaces, in ditches and around culverts, deliver sediment to streams.

Culverts that were poorly installed, poorly located, or have rusted through are causing stream channel sediment delivery. Culverts along the Sandy Creek Mainline Road were inventoried in 1994 and several which were found to be rusted through were replaced under the 1995 "Jobs-in-the-Woods" program. Culverts were randomly surveyed in July 1996 along Slide Creek Road (built in 1972) and Frenchie Creek Road (rebuilt in 1967). These two roads are among the oldest BLM roads in the analysis area with the most length impacting riparian areas. Most of these culverts were rusted through or deteriorated to a point where they will fail in the near future (5 years ±). Culverts which had the most advanced deterioration were located in perennial streams. Grade culverts, which carry storm runoff from the road surface and ground water intercepted from the cut bank, were not similarly affected. Most all the soils in the analysis area are corrosive to uncoated steel. This factor combined with the erosive nature of the coarse sediment may explain the high number of culverts rusted through at the bottom with the rest of the walls still intact. In addition, where the outlet end was not located on resistant material, the water flowing out from the outlet was eroding the soil away.

As they weather, the older Otter Point and Roseburg formations tend to produce more silt and fine sediment than the other younger formations. Channel forming and erosional processes (e.g., gullying) will occur on the lesser slopes of the Otter Point formation due to the lack of resistance to erosion inherent in this formation. Aggradation of the Belieu and Anderson Creeks may be a result of the stony parent materials found in the Otter Point formation and should be carefully considered if harvest activity is to take place in these drainages. Past entry into these areas has removed the large woody structures that were necessary to trap fine, as well as, the larger coarse sediments (see Section III.6 - subsection Aquatic Habitat)

The trend within this analysis area is that it will continue to receive pulses of sediment as private lands are harvested. However, the rate of onsite soil loss should be less than from previous management activities, as there will be less new road construction, harvesting disturbance from ground-based systems, and improved techniques. Existing BLM-controlled roads that have been degraded will be improved and possibly be closed to traffic and erosion proofed. On BLM administered lands the rate of surface erosion will decrease through the establishment of Riparian Reserves, less intensive harvesting levels, and lower road densities open to traffic north of Highway 42.

<u>Management Objective</u>
A management objective for BLM-administered roads and lands is to return to historic types of landsliding, especially debris torrents which deliver and route wood and sediment in stream channels. It is also desirable to limit the effects of management on the rates of surface erosion and sediment delivery to streams. This can be accomplished through control measures in harvest areas and along roads that trap fine soil material close to the source areas (e.g., revegetation, maintenance of Riparian Reserve areas, and others). A reduction in the rate of road related and harvest failures should be strived for on both the private and BLM administered lands.

SITE PRODUCTIVITY

<u>Analysis Questions</u>:

What is the current status of the site productivity within the watershed?

Has soil productivity suffered a loss through past management practices?

What soil components are most prone to degradation and result in lower site productivity?

What are the influences and relationships between erosion processes and other ecosystem processes (e.g., vegetation, woody debris recruitment, aquatic habitat, etc.)? How have management activities affected these relationships?

What is the <u>management objective</u> for site productivity within the analysis area?

Site productivity is the ability of the soil to grow plants and produce a product without sustaining a long-term decline in the level of production. The combination of the physical and biological properties found in the soil environment together with the processes that link them to a growing plant define the site productivity.

REFERENCE CONDITION

There is no reference condition for site productivity that can be defined in absolute values. The production capacity of any given piece of land is dependent on five factors: infiltration rate, moisture holding capacity, base nutrient levels, organic matter levels, and the level of biological activity and presence of species dependent micro organisms.

CURRENT CONDITION

Site Productivity

An analysis of the site productivity of the watershed was conducted using two sources of data; BLM's GIS database, and the site index listing for each soil type from the county soil survey conducted by the Soil Conservation Service (Table III.1-3).

Table III.1-3 Site Productivity within the Watershed

GIS Database		Soil Survey Database	
Site Class	***% of Analysis Area***	***Site Class***	***% of Analysis Area***
NO DATA	56.4*	NO DATA"	2.0
1	0.2	1	56.0
2	22.5	2	34.0
3	19.3	3	0.0
4	1.0	4	8.0
5	0.1	5	0.0

*No Data for private lands on GIS data base

**Based on Kings Site Indexes

"No Data soil types normally agricultural lands

Data from the two sources is not consistent. By extrapolating BLM's GIS data base for private lands, one can conclude that most lands are site class 2 or 3. Using the soil survey, the productivity level of the analysis area increases to site class 1 and 2, either way, the watershed is considered highly productive based on site class.

An overall determination was made on the 23 different soil types for permeability, bulk density, limited water availability, and organic matter percent. Soil types common to the alluvial flood plains such as 10B, 33, 47B, 4D and E, and 63B and C are slow to drain and can have water in excess that reduces growth. Bulk density seems to be limited on the older Otter Point soils of the 53D and E type. Soil types found on ridges such as the 14F, 15F or 58F have very low available water throughout the year. Organic matter is most limiting on the ridge top and Otter Point soils, 14F, 15F, 38, 50E, 58F, 53D and E but, also on some bottom land soils, 17B and 24.

Most soil types in the watershed are rated as having good available water capacities (6.5 to 12.5 inches) and moderate to rapid rates of permeability (.06 to 6.0 inches/hour). These two qualities of the soil allow for water to be taken in quickly and deeply and held in place for plant growth. Those soils with 0.5 to 1.5 inches of water available to plants will not provide for water into the late summer months. These soils are generally ridge-top in location and do not have high site indexes, normally site class 4. Soil types that have 0.06 to 0.2 inch/hour intake rates are found on the river flood plains and some moderate sideslopes.

Infiltration rates are tied strongly to bulk densities. A bulk density of more than 1.6 can restrict water storage and root penetration. The range of bulk densities range from 0.9 to 1.5 with the Serpentano type (53) and the Remote type (50) being the most limiting. Although these soils appear to limit plant growth, they still have site indexes of class 2 and 1 respectively. This demonstrates the complex nature of site productivity. One factor alone does not impact the entire function of the soil to produce.

Erosion can remove soil when vegetative protection is lost through ground based harvest systems and burning for site preparation. This type of reduction to site productivity is largely confined to private lands where ground based harvest systems have eliminated the vegetational cover, and where gullies have formed on the skid trails. Ground based harvest systems have not been widely used on BLM administered lands thus no reduction in site potential is expected.

There are four soil types that are shallow and most prone to nutrient degradation from management related activities. The Digger-Preacher-Umpcoos (14F), Digger-Umpcoos-Rock outcrop (15F), Milbury-Bohannon-Umpcoos (38F), and the Umpcoos-Rock outcrop (58F) are all listed in the Coos County Soil Survey as having 10-20 inches of soil above bedrock. These soils make up 36% of the analysis area, but the area covered by the very shallow soils only covers a little over 16% of the area. Rock outcrop and Umpcoos soil types normally are found on the narrow ridges, steep side slopes or convex side slopes adjacent to rock outcroppings. These soil types are rated site class 4 or not rated as they do not commonly grow commercial tree species.

Additional soil nutrients are incorporated into the soil by the addition of fertilizers, nitrogen fixation by plants, nitrogen fixation by micro-organisms such as fungi and lichens, or contained within the rain that falls on the watershed. Both private timber companies and the Bureau of Land Management have applied nitrogen fertilizer to portions of the watershed as an intensive silvicultural management activity.

The distribution and abundance of Ceanothus and red alder in harvest units, primarily in Sandy and Slide Creek drainages, have been reduced through management activities (manual maintenance contracts and herbicide spraying). This has resulted in reducing the amount of time which nitrogen fixation could have occurred on these sites. Currently, Scotch and French broom are spreading on private and some BLM administered lands in the lower Sandy Creek drainage. Although these plants do accumulate nitrogen into the soil they are considered noxious weeds and not encouraged to grow on BLM managed lands.

Nitrogen fixation by lichens and micro-organisms also contribute to the nutrient base of the soil. No measure of the population levels, species or distributions has been made for the analysis area. Reduction of these processes may have occurred through harvest, burning, herbicide applications and road building activities but to what degree is unknown.

SYNTHESIS & INTERPRETATION

When all the factors are taken into consideration, there are two that appear to be most prone to degradation by the management activities. The bulk density and organic matter content of the soil have the greatest impact to overall site productivity. These two components are intricately linked and are heavily impacted when certain harvest conditions exist. In situations where timber is removed without regard for maintaining the naturally high infiltration rates and where organic matter is drastically removed from within the upper horizon of soil, there can be a reduction of site productivity. This type of harvesting is common where ground based systems are used to remove the timber or where broadcast burning is poorly controlled and fire intensities and durations are high enough to remove the organic layer.

Site productivity has not suffered much loss through past management practices. Soil is a fairly tolerant entity and with the climate, species, and rainfall the Coast Range experiences the recovery of degraded sites is minimum. However, such degradation on a continual basis can in time reduce the productivity of the soil. Modeling for site productivity for the RMP showed continual removal of timber on less than a 40 year rotation would over time be a loss to site productivity.

Without the continued high productivity of the soil it will take longer to provide the key large woody material and shade to stream systems. The ability of the land to re-vegetate after disturbance will lengthen and allow the process of surface erosion to become more important in producing fine sediment in the stream systems. Water quality and quantity could be reduced if components of site productivity are reduced. Other plant and tree species become better at occupying some sites and although diversity would increase the ability to provide wood products would decrease.

<u>Management Objective</u>

For any soil, the maintenance of site productivity requires that forest-management activities minimize the withdrawals of site resources and the timely replenishment of those resources. Four actions should be optimized when striving to maintain site productivity. 1) Minimize disturbance severity (i.e., intense burn, soil compaction or erosion), 2) retain organic matter, 3) re-vegetate with indigenous species and associated soil organisms, 4) recognize harsh sites as those most susceptible to productivity losses.

COMPACTION

<u>Analysis Questions</u>:

What level of compaction due to roads and other management activities exists within the watershed?

Is compaction of the watershed hindering soil or plant functions in the watershed?

What are the influences and relationships between erosion processes and other ecosystem processes (e.g., vegetation, woody debris recruitment, aquatic habitat, etc.)? How have management activities affected these relationships?

What is the <u>management objective</u> for the level of compaction within the analysis area?

REFERENCE CONDITION

The level of compaction for the analysis area in an unroaded, unharvested condition, could not be measured.

CURRENT CONDITION

With the introduction of road systems and the various methods to remove timber from this watershed, the level of compaction has increased. Harvest in the early 1940's employed cable systems that dragged logs across the land. Later, ground based systems expanded the compaction to the size of the equipment skid trails. Some of these early trails have been revegetated for a sufficient length of time that the impacts no longer influence surface runoff or growth rates. There are areas, particularly the roads and skid trails in more recent harvest areas that still affect these factors and are of concern.

SYNTHESIS & INTERPRETATION

The roads and equipment trails, present in the GIS data base, represent 289.2 acres of the 23,982 acres in the analysis area. This calculates to an average level of compaction of 1.21%. Road length was converted to acres using an assumed width of 14 feet for all surfaces and only those roads and cat trails identified from the 1986 aerial photos are present on the database.

No systematic survey of the analysis area was conducted to determine the level of recovery of the compacted skid trails. However, a field review of the salvage logging areas from the 1970's showed the skid trails to be in various states of recovery. Skid trail construction usually removes the top soil so that many skid trails may never fully recover to the unroaded condition. Attempts have been made in the Sandy Creek drainage to decompact part of the road surfaces with a winged subsoiler in the summer of 1995 as part of the JIW contracts. Results from this work showed an overall success to be accomplished on soils that were deep to the bedrock layer. The technique was less successful on full bench constructed roads where only the top 4 to 10 inches was decompacted.

The level of compaction due to harvest within the analytical area has not been measured. Based on an aerial photo review from 1943 to 1992, harvest activity within the sub-watershed has increased the level of compaction on private lands more than on BLM administered lands.

Harvest on private lands makes extensive use of ground based systems and that type of activity is still evident on the 1992 photos. Lands harvested using ground-based systems were generally found on slopes below 40% these systems can lead to compaction rates of 30%. As a general rule, Hi-lead cable systems were employed on slopes greater than 40% or where ground based systems were not economically feasible. These cable systems have been found to increase the level of compaction from 3 to 12%. Because private lands are a mixed mosaic of ground and cable systems, many times on the same piece of ground it is difficult to place a level of compaction due to harvesting on them in this watershed analysis.

On BLM administered land entry with ground-based systems in the 1943 photos is only on those lands where roads and slopes are less than 30%. Most of the BLM lands have been harvested using cable systems to remove the timber. Past monitoring of harvest units on BLM administered lands in the watershed for compaction and site disturbance has not identified a level of compaction that exceeds 5%, well below the 12% level established in the monitoring process (USDI Handbook 1734-1).

With this level of compaction in the watershed there is no reason to suspect that any soil or plant functions are being hindered on a large scale but, some local influence on private lands can be expected. Lands taken out of production for the purpose of roads are not expected to grow plants and are not considered when calculating the productivity of the watershed. Increased stream networks as a result of road surfaces do not appear to be a major factor due to the low 1.21% of the land in the roaded state.

The trend for the analytical area on private lands, with respect to compaction, is for less compaction to occur on these lands. The practice of ground based systems for harvest is being replaced by the use of low ground pressure mechanical harvesting systems. This system does not disturb the ground in the same manner as past ground based systems. The level of compaction they impose of the land is still unknown but, with the ability to operate on limbs and logging slash and the use of previously constructed haul roads it is thought to be only slightly more than cable systems. On BLM administered lands, the trend will be towards fewer permanent roads open to traffic. Harvesting will be conducted with the build, use, and close policy as a means of reducing road densities and lowering maintenance costs. The TMO process used in this watershed analysis recommended many closures and improvements that will lessen the level of compaction over time and reduce sediment in the near future.

Management objective

The level of compaction on BLM administered lands set forth in the RMP is not to exceed 12% of the land. This excludes roads and is confined to the operable land surface. An increase over that percentage will affect the ability of the land to produce timber at the prior calculated rate and is unacceptable.

III.2 CORE TOPIC - HYDROLOGY

Analysis Questions:

What are the dominant hydrologic characteristics and other notable hydrological features and processes in the watershed? (refer to Section 1 - Characterization)

What are the historical hydrological characteristics (eg., peak flows, minimum flows) and features in the watershed?

What are the current conditions and trends of the dominant hydrologic characteristics and features prevalent in the watershed?

What are the natural and human causes of change between historical and current hydrologic conditions?

How have natural and human caused changes in water quantity and timing of flows affected water quality?

How much surface water is being used for <u>out of stream use</u>s, and where are points of diversion (including domestic sources)? What effect does this have on available summer flow?

What are the influences and relationships between hydrologic processes and other ecosystem processes (eg., sediment delivery)?

What is the <u>management objective</u> for the hydrologic processes in the watershed?

A general overview of the analysis area's hydrology and watershed characteristics is contained in Section I, Characterization. Watershed hydrology includes floods, distribution of flows, annual yield, and minimum flows.

REFERENCE CONDITION

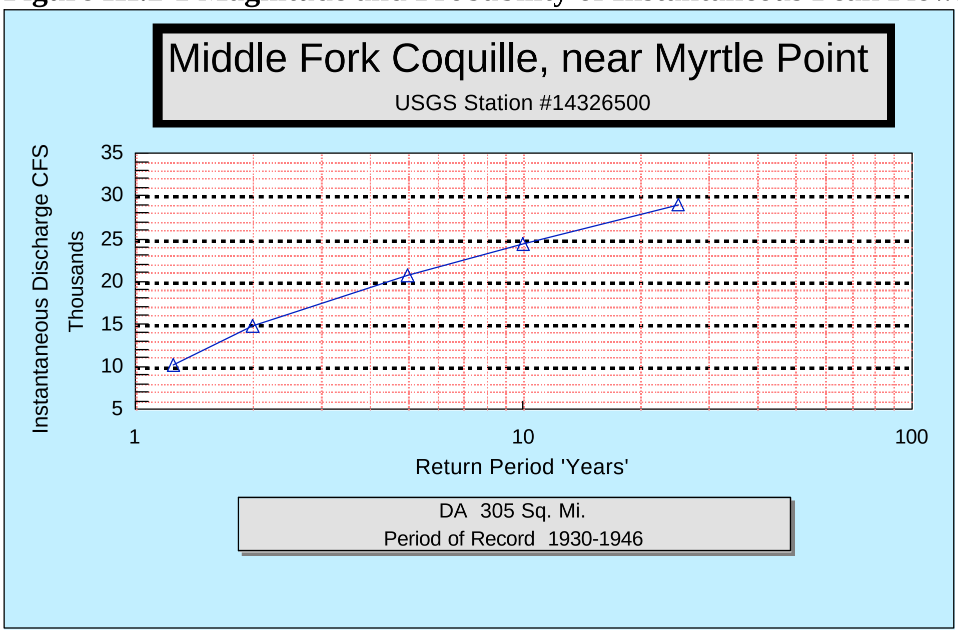
There is insufficient monitoring data to establish a comparison between current and historic hydrology and changes from land management.

CURRENT CONDITION

<u>Peak Flows</u>
Precipitation runoff is described in instantaneous peak flow in cubic feet per second (cfs), calculated from a flood frequency curve, or estimated by other methods. Annual peakflow for a given drainage is highly variable from year to year. A frequency analysis establishes a relationship between the magnitude of the flood and its return period.

There are no precipitation or runoff gaging stations in the Sandy-Remote analysis area. The nearest USGS water gage No. 14326500, on the Middle Fork Coquille, is 2 miles upstream from the South Fork Coquille and 7 miles West of the analysis area. This station was in operation from October 1930 and discontinued in September 1946. Unfortunately, there were not any big floods during these years. There may have been some flow regulation in the winter and spring months, because of the operation of splash dam log ponds. The highest measured discharge was 23,600 cfs, and occurred on January 2, 1933. Peak flow estimates were obtained by statistical analysis of station data, and values were taken from the frequency curve. (Wellman et al.1993). Figure III.2-1 shows the magnitude and frequency of flood flow derived from the Middle Fork Coquille station. The flood frequency curve for the Middle Fork Coquille USGS gage could not be used for events greater than a 25-year flood, because of the relatively short period of record (16 years).

Figure III.2-1 Magnitude and Probability of Instantaneous Peak Flows



Observed extreme storm periods were developed from data taken at the South Fork Coquille River gage No. 14325000 near Powers, OR., because this station has a long record (77 years), and is near the analysis area. The largest flood to occur within the Middle Fork Coquille watershed was in 1964, which was in excess of a 100-year return frequency. Descriptions of these historic floods, with a 20-year return frequency or greater, are shown in Appendix B.

The flooding in 1955 seems to have been especially severe, with water covering the Sandy Creek bridge and a portion of highway 42 near Remote. Based on the South Fork Coquille USGS gage near Powers, OR. the return frequency of this storm was 20 years. Fairly good records of the flood history for the Sandy Creek area exist in the form of anecdotal accounts from early settlers and local residents. Local residents of 50 years or more have noted that flood waters rise and dissipate more rapidly than in the past (BLM 1993).

Precipitation as snow can accumulate in the higher elevations of the watersheds (above 1800 feet), but usually is transient and only persist a few days to weeks (Figure III.2-2). Weather conditions including warm winds and rain can cause rapid melting of the stored water equivalent

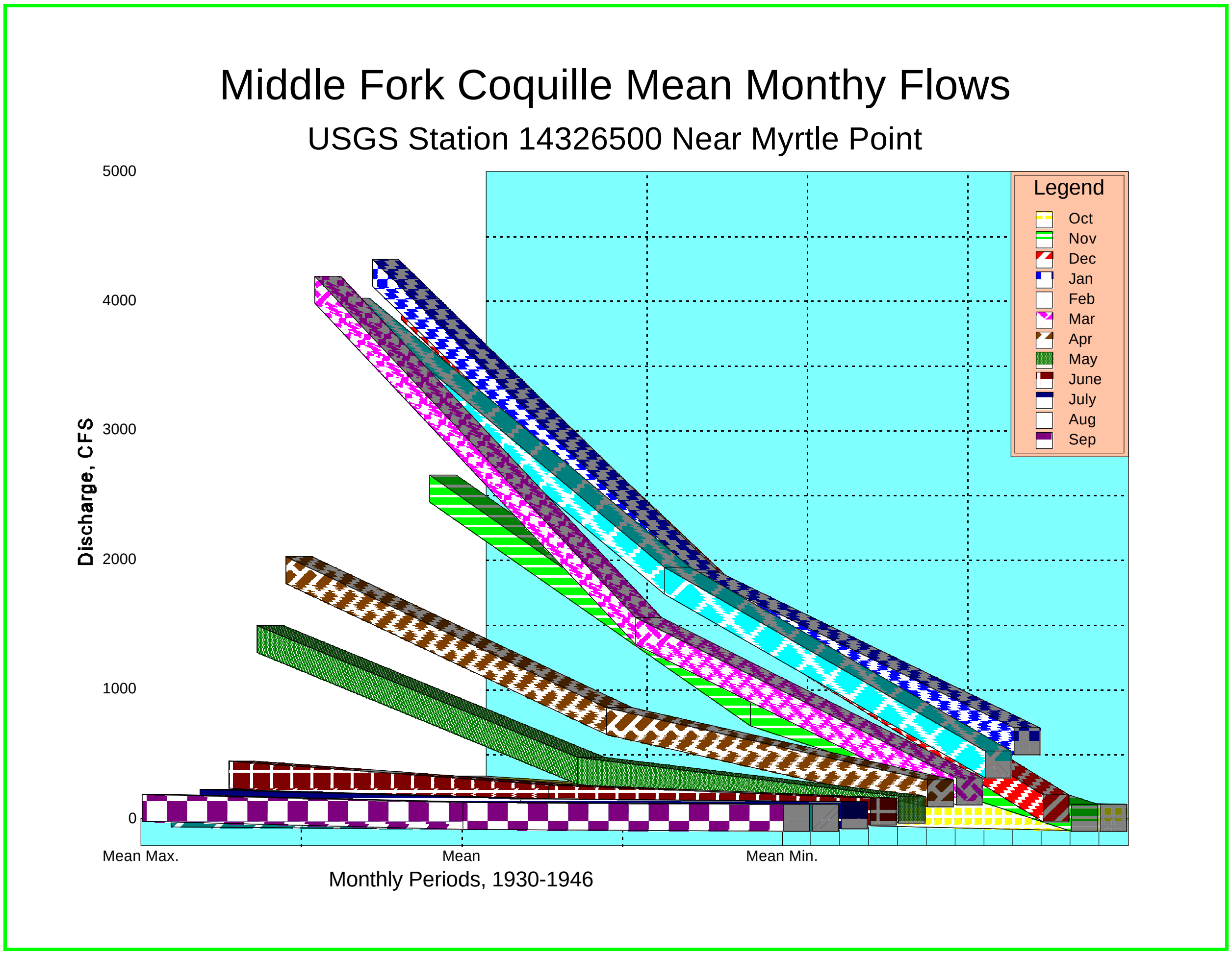
Snow Zone map

as snow pack. Snow will accumulate and melt faster in openings than the surrounding forest. This process can increase peak flows, depending on drainage factors and vegetative age and condition. Sandy Creek is the most susceptible to this phenomenon as about 18% of the drainage can retain snow for short periods.

Annual Flow and Yield

About 60% of the annual runoff occurs between December through February, with January being the highest month. June through October contribute only 4% of the annual runoff and results in very low stream flows. This annual runoff distribution very closely follows the precipitation pattern. Mean Monthly discharge for the Middle Fork Coquille River, based on the discontinued USGS gage No. 14386500, is shown in Figure III.2-3. Mean annual discharge is 743 cfs or 538,000 acre feet per year. This mean annual runoff corresponds to 2.44 cfs mi.[2.]

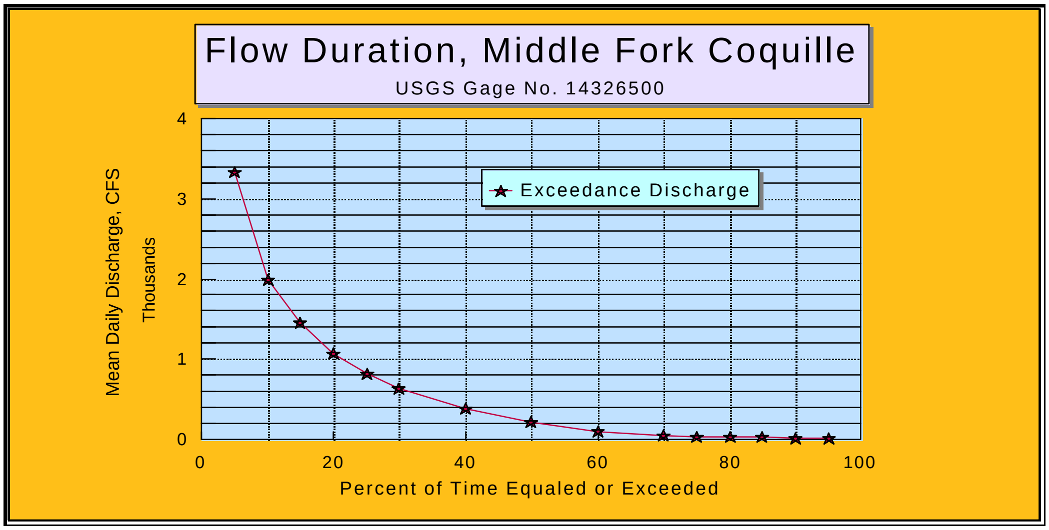
Figure III.2-3 Middle Fork Coquille Mean Monthly Discharge for the Period of Record.



Flow Distribution

Figure III.2-4 shows how flow is distributed throughout the year in terms of flow duration. Large to extreme flows occur less than 5% of the time, moderate flows occur 40% of the time, and low flows occur 50% of the time. The same general curve shape and results should be able to be applied to the analysis area by an area adjustment. Notice that the average annual flow (743 cfs) is equaled or exceed only 25% of the time. The frequent or dominant discharge is considerably less than a bankfull flow (10,500 cfs mean daily flow). Channel formation processes are caused by flows which fill the channel to bankfull or beyond, while channel dimensions are maintained by the frequent flows.

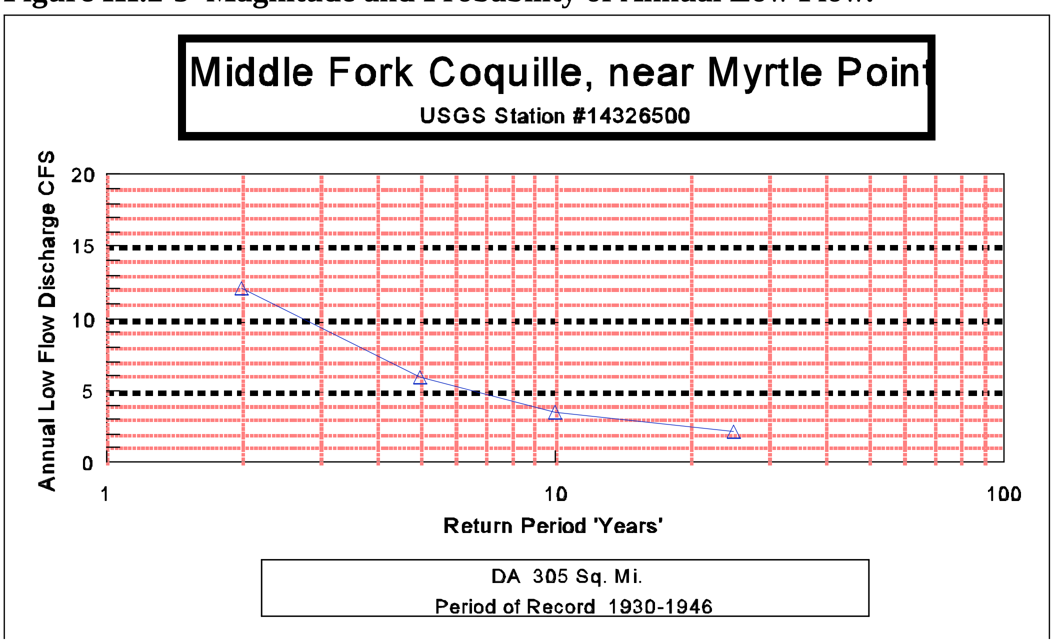
Figure III.2-4 Daily Flow Duration for the Sandy-Remote Analysis Area



Minimum Flow

Because rain is essentially absent in the summer, stream flows become extremely low in mid August-October along the Middle Fork Coquille and other tributary streams. Figure III.2-5 shows the magnitude and frequency of low flow taken from the Middle Fork Coquille USGS station. Average two year recurrence interval 7 day low flow is about 0.04 cfs/mi^2, and <0.046 cfs/mi^2 for consecutive periods of up to 30 days.

Figure III.2-5 Magnitude and Probability of Annual Low Flow.



Significant recorded 7 consecutive day low flows occurred between September-October in 1931, 1933, 1939, 1974, 1987, 1991, 1992 and 1994. The USGS stream flow gage 14325000, near Powers OR., was used to reconstruct the record for periods outside the station operation. The return period for these 7 day low flows are 20 years or greater. The low flows in 1991, 1992 and 1994 were 100 year events (Wellman et al. 1993).

Many of the "headwater" first order streams are on coarse textured high permeability soils and go dry as the summer progresses (Figure III.8-3, pg. 134, shows a representation of these intermittent streams). Other low order streams originate from seeps and drain fine textured, deep, high porosity soils. Sometimes there is land form controlled perched water tables. These stream types have a very low, constant flow, but may have "dry spots" in the channel in later summer. Higher order channels, may have late summer pools with little conveyance of flow downstream. During the summer/fall period, live stream flows are so low they are measured in gallons per minute. Stream flows may actually increase at night, because evapotranspiration demand is at the lowest point on a diurnal cycle.

<u>Water Uses</u>

Drainages in the analysis area supply drinking water, domestic use, and irrigation to local residents living along the rural forest interface. In addition, numerous wildlife and plant species are dependent upon the drainages for both drinking water and aquatic habitat. Salmonids, in particular, require an adequate, year-round flow of cool, clean water to thrive.

Figure III.2-6 shows the present locations of the surface water diversions for domestic water supplies along Sandy Creek. There are 15 occupied residences in the Sandy Creek subwatershed; 11 of these rely on surface water, while the remaining four have wells. According to the Coos County Water Master, the maximum withdrawal (peak consumption) for the four permitted surface water users totals 0.5281 cfs, and the average consumption is approximately 176 gal/day/household. A representative of the Coos Bay Water Board stated that his figure for average rural residential consumption was 350 gal/day/household. The actual consumption is not metered, and is therefore unknown.

Many of the surface-water withdrawal systems include a catch basin and/or settling tank to reduce particulates; some systems have neither. Only two residences reported having water treatment systems; one using an ultraviolet light, and the other chlorine.

The identified water systems in the Sandy Creek subbasin do not supply more than three households each, and are therefore unregulated by state or federal laws regarding drinking water. As such, no water quality testing has been required, nor is any known to have been conducted to date. Thus, no water quality data specific to Sandy Creek is available at present. This was verified by representatives from the Oregon ODEQ, Oregon Health Division, and Coos County Health Dept. However, it should be noted that a few residents cited occasional periods when their tap water was discolored by sediment. One resident also stated that his surface water supply often dried up in the summer.

ODFW has applied to the Oregon Water Resources Department for various minimum instream flows on the Middle Fork Coquille (ODFW 1992a). Application #72527, located between

Water Diversion map

rivermile 7.8 at Big Creek to rivermile 15.6, at Sandy Creek, with a priority date of 6/30/92, has a summer minimum flow of 65 cfs. This application would exceed available stream flow during the dry period, and the flow claim is based on habitat, not hydrology. Sandy Creek has a similar minimum instream flow application # 72792, with a priority date of 9/08/92. The minimum flow is for 27 cfs, during the summer months, from the mouth to an unnamed tributary. Other streams in the analysis area do not have any instream minimum flow protection pending, but are at low risk for water withdrawals or flow modification.

There is the potential for hydro-power generation on Sandy Creek. In 1983, there was a petition to construct a small (3,300,000 kwh/yr) hydroelectric plant on Sandy Creek. The proposal included an intake and diversion above the cascades in T29S-R10W-2 NW¼, and a 5000 ft. pipe transporting the water to a powerhouse located in T29S-R10W-11 NE¼. It is uncertain at present why the plan has not come to fruition; however, comprehensive watershed planning should take the possibility of similar projects into account.

A reservoir water source option has been identified on the Middle Fork Coquille near Remote, just to the East of the analysis area (CH2MHill 1993). A new dam and reservoir would be constructed on the mainstream, at a point above tidal influence. The water would be diverted, treated and piped to demand centers. This option is considered fatally flawed because anadromous fish runs exist in this section of the river and ODFW highly opposes this site.

SYNTHESES AND INTERPRETATION

<u>Extreme and Frequent Peak Flows</u>

Extreme flood flows (greater than a 20-year return frequency) have occurred in 1934, 1955, 1964, 1971, and 1974. These floods are the result of natural weather patterns and flashy watershed response. Forest management has had little to do with the magnitude of these events. Major channel adjustments have resulted from these infrequent flows.

Frequent flows (those discharges that return several times each winter season), and the bankfull flow (return period of 1.5-2 years and fills the active channel) are responsible for maintaining channel dimensions and moving most of the sediment load. Watershed studies in the northwest have shown that following road building and timber cutting, peakflows may increase, decrease or remain unchanged. The magnitude of the change varies from a 36% decrease to 200% increase and depends on specific watersheds and storm factors(Reiter et. al. 1995). It is unknown whether the frequent flows have increased peaks in the analysis area due to forest management. The high flows that occur in the spring and fall are likely increased, due to reduced transpiration and interception losses following harvest, but these are usually considerably less in magnitude than the frequent flows.

<u>Annual Yield</u>

Because of the effects of forest harvest and road building, annual yield has increased. Annual increases in evapotranspiration of 25 inches for coastal forest are common. This is about 40% of analysis area drainages precipitation. However, because of increased evaporation and soil detention storage on cleared land, not all of this additional water is available for runoff. Compacted surfaces including roads, landings and skid trails can permanently increase runoff and yield. The amount of increased annual runoff in the analysis area is not known, but suspected to be in the range of 10-20%. The current vegetative condition shows 30% of the analysis area is less than 15 years of age and 42% less than 25 years of age. These are hydrologically immature timber stands, which are using water at less than potential transpiration rates. As more acres of forest vegetation reach hydrologic maturity (±40 years old), this increased yield will decline.

Timing of Flow

Fall, early winter and spring flows may have increased, due to forest management in the drainages by reduced transpiration from trees, and increased soil moisture content going into the rainy season. Until forest vegetation is hydrologically mature, higher magnitude frequent flows may be occurring. Roads and ditchlines may be acting as extensions of the road network. This factor along with changed subsurface flow along roads and quicker runoff from compacted areas may be advancing timing in the tributary streams for a storm. This may indicate a faster hydrograph time to peak and recede as the storm passes, than may have happened in the past. The drainages have always been "flashy" in response to precipitation because of limited soil and groundwater storage.

Minimum Flows

Average two year recurrence interval 7 day low flow is about 0.04 cfs/mi^2, and <0.046 cfs/mi^2 for consecutive periods of up to 30 days. These values are nearly one half the amount of other Coast Range streams. Extremely low flows (those > than a 20-year return interval) have occurred eight times in this century, with 100 year lows in 1933, 1991, 1992 and 1994. During these periods, there was essentially no live flow. The reader is referred to Section III.3-Stream Channel for a more in depth look at low flow and stream channel processes.

Trends

Annual yield will decrease and the frequent peak flows may decrease as young timber stands in the analysis area drainages age and become more efficient at transpiring water. Extreme peak and minimum flows are dependant on climatic patterns.

Management Objective

The management objective for the analysis area is to: A) continue with forest management and other activities in such a way as to minimize the risk of increasing peak flows or altering timing of runoff, and B) provide uninterrupted supplies of high quality water at the boundaries of BLM administered lands to domestic and other water uses.

III.3 CORE TOPIC - STREAM CHANNEL

Analysis Questions:

What are the basic morphological characteristics and processes in the analysis area drainages? (refer to Section 1- Characterization)

What were the historical morphological characteristics and processes in the analysis area drainages?

What are the current conditions and trends of stream channel types and sediment transport and deposition processes prevalent in the analysis area drainages?

What are the natural and human causes of change between historical and current channel conditions?

What effect have changes in channel morphology and riparian vegetation had on summer low flows?

What are the influences and relationships between channel conditions and other ecosystem processes in the watershed?

What is the management objective for stream channel types in the analysis area drainages?

Stream types can best be described by stream channel similarities and differences. Rosgen classification system was used as a basis for comparisons (Rosgen, 1994). The alpha designation in Rosgen's classification system identifies the channel gradient and other general hydraulic relationships. The numeric designation refers to the substrate type. Table A-1, Appendix A shows a brief outline of this classification system and hydraulic relationships, for stream types found in the analysis area. Figure III.3-1 shows generalized Rosgen Stream Types for the Sandy-Remote analysis area.

REFERENCE CONDITION

High Gradient Channels, Rosgen A Stream types
These high gradient (>10%) stream channels are usually first and second order streams. Streams in unmanaged timber stands are still representative of the historic condition.

Moderate Gradient Channels, Rosgen B Stream types
These moderate gradient (4-10%) transitional stream channels are usually 3rd order streams. Few reference areas remain in the analysis area. This channel type contained steps formed by Large Woody Debris (LWD) that are critical to maintain stream energy dissipation and prevent lateral adjustment and bankcutting. Embedded channel spanning LWD results in low velocity flats for sediments to be deposited into long term storage.

Rosgen map

Low Gradient Channels, Rosgen C and F Stream types
These low gradient (<2%) stream channels are usually 4th order and greater streams. The probable historic condition for these channels included streams that were narrower, unconfined at flood stage and able to use the floodplains, and had stable banks anchored by root masses with myrtle, maple, cedar and other tree species. Greater numbers of downed LWD were in this channel type, but living trees providing bank stability were more important than the influence of log steps. These channels dissipate energy by meandering and roughness elements along the banks and bed.

High densities of LWD in log jams and beaver dams are thought to have contributed a larger role in maintaining pools and in channel water storage in these low gradient stream types. This water would slowly be released during the summer low flow period.

CURRENT CONDITION

High Gradient Channels, Rosgen A Stream types
These are steep, V shaped, erosional, straight channels which lack a floodplain. Many are confined by bedrock channels and steep banks. About 223 miles (79%) of all channels in the analysis area fit this type. The main process affecting these channels are infrequent landsliding and debris torrents. Review of past aerial photography indicates that although incidences of debris avalanches and debris slides into channels have increased from forest management, rapid movement down first and second order channels by torrenting has probably not been accelerated (see Section III.1-Erosion Processes).

The analysis area has many type A first order channels on bedrock (A1). These stream types are associated with soil mapping units 14F, 15F, 46D, 46E, 46F and 58F. A1 channels on these soils are often intermittent, because the catchments are small (20-60 acres), soils are shallow, have high hydraulic conductivities (2-6"/hr.) and bedrock is basically impermeable to water. Figure III.8-3 shows these stream segments on BLM administered lands. These channels are moderately sensitive to disturbance, have good recovery potentials and moderate streambank erosion potentials. Sediment supply is low-moderate, except when torrents occur.

A1 stream types are prone to the debris avalanche and shallow rapid debris flow process. The most frequently occurring landslides were found on soil mapping units 14F, 15F, 46F and 58F (Table III.1-1). The avalanches, debris slides and sometimes resulting torrents usually occur when concave hollows on headwalls above these channels are loaded with colluvium, soil materials and organic debris by natural or disturbance processes. When prolonged precipitation saturates thin soils, shear strength is reduced and failures are likely. This has been observed to be associated with the 5-10 year recurrence interval storm. Shallow rapid debris torrents travel at 35-40 mph and are devastating to low order channels. They are responsible for scouring bed and banks, carrying huge volumes of sediment, and leaving depositional fans at high angle, tributary junctions. This perpetuates the A1 channel type, by passing large debris, gravels, and high sediments downstream to higher order depositional stream types. This process occurs on an infrequent basis.

Other type A first-second order channels occur on silt/clay substrates and are associated with soil mapping units 4D,4E,10B,17B,33,47B,63B,63C,53D, and 53E. These A5-A6 channel types originate from seeps and have a very low continuous summer flow. Some of these channels are draining perched layers of water in deep soils on gently sloping land forms. They are very sensitive to disturbance, have poor recovery potentials and very high streambank erosion potentials. Sediment supply is very high.

The upper extent of intermittent streams on district lands has been studied in two different geologies by using the intermittent stream ROD definition and interpretive criteria and found to form at drainage areas between 4-13 acres with a tendency of about 7 acres (Carpenter 1995).

Moderate Gradient Channels, Rosgen B Stream types

These are moderately sloped, slightly meandering channels which either lack a floodplain or have very limited development. About 28 miles (10%) of all channels in the analysis area fit this type. Many B stream types are perennial. The main processes affecting these channels are the input of water, sediment and LWD from upslope channel segments, and some bankcutting and entrenchment. Much LWD has been removed from this channel type, which is necessary for energy dissipation through step/pools. A consequence of past downed LWD and riparian trees removal has been channel widening and downcutting or entrenchment. Sediment is being accessed from streambanks, or moved in from upstream stream types (A types), and temporarily stored behind obstructions or localized flats where natural stream grade controls are present. Where stream slopes exceeds about 2%, fine and coarse sediments are moving downstream during frequent flows. This stream type will not aggrade, even when sediment supply is high. However, without LWD wood structure in the stream, limited areas are available to trap gravels for fish spawning beds.

Low Gradient Channels, Rosgen C and F Stream types

These are low lying, meandering, wide and slightly entrenched to entrenched channels with a variety of substrates but with a high proportion of fines. About 31 miles (11%) of all channels in the analysis area fit these types. All C and F channels are perennial. These channel types are located lower in the drainages, along 4-7th order streams and have larger contributing areas. This includes the lower 5 miles of Sandy Creek and the Middle Fork Coquille River. The main precesses affecting these channels are the input of water and sediment from upstream channels (A and B stream types) and lateral and vertical adjustments through bankcutting and channel scouring.

Early century modification of these channel types has occurred, including riparian and flow changes, causing concurrent hydraulic changes and loss of stream pool volume and axial stream water storage in floodplains. Two splash dams placed across Sandy Creek in the lower five miles during the 1920's removed most of the large wood and boulders and destroyed channel structure. Sandy Creek downcut and changed from a C to an F type channel, losing connectivity with its floodplain. The channel subsequently widened, straightened and pools were less frequent and water storage volumes reduced.

The Middle Fork Coquille River was likely a C stream type channel before three splash dams were built by the Middle Fork Boom Company in 1924. The valley bottom and flood prone area was never more than about 1.5 times the active channel width due to constraint by hillslopes. Torrents of water, when released form the splash dams, downcut the channel to bedrock, caused widening and loss of channel structure. Construction of Highway 42 further constrained the channel through many segments. Today, the Middle Fork Coquille is an entrenched F type channel.

Low gradient channels are depositional areas for sediment. These stream types can easily be identified in longitudinal profiles shown in Figure I-8. The higher frequent flows will move sediment along the bed and banks and will be redeposited downstream toward the estuaries. It appears lower Sandy Creek and Middle Fork Coquille are not in equilibrium as the supply of fine sediment exceeds the transport capabilities (see Section III.4-Water Quality). The result has been channel widening and bankcutting

SYNTHESIS & INTERPRETATION

<u>Management Effects on Stream Channels</u>
Logging and road building, which begin in the analysis area in the early 1950's, has affected the stream channel's ability to function and remain stable. Nearly all of the private land and 39% of BLM administered lands has been harvested. Increases in annual yield has occurred and some peak flows have been elevated. Existing roads may be causing quicker runoff to tributary channels because road system ditches act as extensions of the stream network and storm flow is quickly routed (see Section III.2-Hydrology) Roads and ground based logging, primarily from private lands, have compacted sites in the analysis area, sometimes more than 12-15% (see Section III.1- subsection Compaction). These factors may have elevated annual frequent discharges allowing degradation to occur in the A and B stream types.

Removal of LWD in stream channels by logging and removing of log jams has led to degradation of all stream types, especially the moderate gradient B stream types. Channel shape, substrate composition and the processes through which the transitional channels dissipate stream energy have changed in response to man's activities. The channel complexity, which involves energy dissipation through turbulent flow and channel roughness has been simplified. Much of the channel roughness provided by LWD has been removed, which changed the flow from a turbulent or varied velocity profile to laminar or a consistent velocity profile. Essentially, the amount of backwater or low velocity, depositional areas provided by log steps have been eliminated. The decreased number of velocity breaks tends to cause the channels to widen and downcut to dissipate the stream energy no longer used in the step/pool flow pattern. Many of the larger channels have scoured to bedrock and have difficulty retaining a substrate. This downcutting has led to the escape of floodplain stored water.

Removal of mixed stands of hardwood and conifer riparian trees, anchoring banks along the low gradient C stream types and early century splash dam logging, has led to channel instability. The streams, downcut, widened and are subject to lateral shifts where land form control is not present. Floodplains were dewatered by entrenchment. Most C stream types converted to an F type.

Photo-interpretation reveals that the rate of landsliding stayed about the same since 1943, but shifted from natural to harvest and road associated failures. The rate of landsliding should have slowed during the 1980's drought years, but did not. This suggests that soil delivery to A and B channels is above the natural rate (see Section III.1-Erosion Processes). Extra or chronic sedimentation to channels, instead of pulses with lapses for a number of years, has caused hydraulic adjustments. Degradation is continuing in the transitional B stream types, primarily by bankcutting. Aggradation/degradation cycles are continuing in C and F stream types, depending on flow levels and corresponding stream energies.

Sediment Transport and Depositional Processes

The A and B stream types, because of their steep gradients, rapidly transport coarse and fine sediment through them. LWD or debris torrent deposits can slow the routing process. Once depressions are filled by sediments behind obstructions, a new equilibrium is reached and incoming sediments will be held in suspension during the frequent flows and moved downstream. Sediment stored behind LWD or in debris fans will remain in long term storage for long periods of time. It can be mobilized again when the organic debris decay or a flood flow rearranges channel debris.

C channels are low gradient, and the active channel dimensions are maintained by the frequent flows. These channels are unconfined at flood stage and entrained sediment will deposit on adjacent lateral floodplains. This is because the floodplains have wide areas spreading water at shallow depths and vegetation providing roughness, which lowers velocity to where coarse and fine sediments cannot be held in the water column. C channels tend to be fairly stable. If aggradation occurs, because chronic or pulses of sediment from upstream overwhelm the transport capability of the stream, aggradation will occur at moderate flows. With a high sediment supply, high flows will build a new higher floodplain, but the C channel will retain its approximate channel dimensions, but at a higher base level in the valley.

Anderson and Belieu Creeks naturally have more coarse sediments and cobbles than other drainages in the analysis area due to the geologic parent material. The lower 1.5 miles of these streams have "flats" that are C stream types. They have been aggraded from past high sediment loads from forest management and are thought to be at a new equilibrium. Portions of lower Slide Creek are C stream types.

F channels in the analysis area have converted from C types, including the lower five miles of Sandy Creek the Middle Fork Coquille, and lower Slide Creek. These are low gradient, entrenched, moderate width channels. Cycles of scour and fill and movement downstream with coarse and fine sediments at moderate flows will continue in these channels until they widen sufficiently so that the cross sectional area diminishes water velocity, depositing sediments during frequent or high flows. In this way a new floodplain will be built by the river within the entrenched channel.

Bank Erosion

Bank erosion, particularly in entrenched B and F channels, contributes sediment to the stream system. During high flows, a larger channel is required to convey the discharge and dissipate the high stream energy. In B channels, the removal of LWD has left stream channels with no way in which to reduce the water velocity in plunge pools, as many channels are downcut to bedrock. Consequently, the channel adjusts laterally, cutting away at the streambank, causing coarse and fine sediments to be entrained in stream flow.

Down valley low gradient C stream types that have converted to an entrenched F type, exhibit bankcutting during frequent flows. This is most evident on the outside of bends where stream flow is cutting under the tree rooting zone. Brush and conifer/hardwood species on the high abandoned floodplain banks can slow, but not stop this widening process. Bank cutting is also taking place where landowners or livestock have removed the riparian vegetation providing bank stability.

Channel Morphology and Riparian Vegetation Effects on Low Flows

Water availability during late summer from base flow is poor, due to the lack of water holding characteristics in the watershed (Section III.3-Hydrology). The drainages ability to produce summer low flows has not changed, but the channel morphology and riparian vegetation has changed. The ability to detain water, and slowly release it over a longer time period has been lost.

There is an implied assumption that the low flow hydrology of the drainages has changed in response to natural events and management activities. This assumption is based on studies in similar drainages. A good discussion on the changes of low flow can be found in Part II, Chapters 3 of "Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska" (MacDonald et al. 1991). Changes in channel morphology and riparian vegetation have affected low flows. Removal of forest vegetation has been shown to increase low flows by reducing evapotranspiration (Harr et al. 1979). With the regrowth of new vegetation this effect declines, but is highly variable. Because summer stream flows are very low in the Sandy-Remote drainages, the additional volume of yield from harvested areas is small. Conversion of tree species from conifer to hardwood species such as Red Alder, can actually decrease summer low flows from preharvest conditions, because these species transpire more water during the summer low flow period and act as phreatophytic vegetation.
No studies quantifying summer water loss in streams due to species conversion have been thoroughly studied (Beschta, 1996).

Morphological changes affecting the retention of low flows in the high gradient (>10%) low order (1-2) high energy channels have been slight. These correspond to the A type channels. Because most of these channels are intermittent; they do not retain summer water. Exceptions are channel types A5-A6 draining deep soils or small perched water tables. Some of the type A channels have been soured to bedrock by debris flows. LWD has been removed from these channels, which acted as energy dissipation steps and sediment catchments. However, this change is thought to have little effect on retention of summer water.

Morphological changes affecting the retention of low flows in the moderate gradient (2-10%) middle order (2-3) transitional channels have been moderate. These are step/pool A and B type streams. Removal of LWD has eliminated the steps and flats behind them. These flats stored large volumes of sediment and near surface groundwater. Pool frequency and depth was higher, below each step. These conditions would allow more summer storage of water, when stream flows were naturally low.

Morphological changes affecting the retention of low flows in the higher order (4-7), low gradient (<2%), depositional stream channels, have been the greatest. The Middle Fork Coquille River and the lower five miles of Sandy Creek have converted from a C to an F Rosgen stream type. Today these stream reaches are totally confined and entrenched, and cannot reach old floodplain terraces. Therefore, loss of floodplain connectivity has occurred. There was considerable near surface groundwater storage in the floodplain alluvium, but cannot be maintained and has been drained by channel incisement. These stream reaches have also undergone much widening, increasing stream width and reducing depth. Early century splash dams, removal of streambank riparian vegetation and removal of instream LWD is largely responsible. Wide, shallow streams retain little water in pools. Sediment delivery from upstream sources may have further decreased pool volume by filling. More beaver dams were probably in these stream types in the past, and their dams would have retained summer water volume.

Stream Channel Trends

The A1 stream types are static, and neither improving nor degrading. A5-A6 stream types are degrading at a slow rate due to headcutting. B stream types are continuing to degrade, where sufficient LWD is absent to form log steps. Most of the C stream types have converted to an F type, and cannot reasonably return to a former state. This is unfortunate, because channel entrenchment has drained much of the floodplain stored water. In some of the wide F segments, a C channel type may be restoring within the F type, but may take many years.

Management Objective

The management objective for stream channel types is to attain a stable channel. Stability means that the stream has the ability over time to transport the sediment and flow produced by the watershed in such a manner that the channel maintains it's dimensions, pattern and profile without either aggrading or degrading (Rosgen 1994). In addition channel LWD structure needs to be reintroduced in the B and C stream types, where deficient, to improve channel condition and ability to store summer water.

III.4 CORE TOPIC - WATER QUALITY

Analysis Questions:

What are the historic and current processes delivering sediment to tributary streams and along the main river?

Specifically, what is the response of the watershed to storm events in regard to producing sediment?

Specifically, how quickly can the analysis area recover from the effects of sedimentation after a major storm event?

Where are the source areas causing sedimentation or stream and is it suspected to interfere with beneficial uses?

Are there, and if so where, are roads that are contributing sediment to streams? Specifically, what is the future monitoring and management of the road system to reduce sedimentation and other potential problems?

What are the processes that are increasing summer stream water temperatures above State ODEQ Water Quality Standards? Which stream segments have frequent accedences?

Are there processes affecting dissolved oxygen levels within the analysis area? If so, identify the processes and what streams are affected?

Are there processes contributing to fecal coliform levels within the analysis area? If so, identify the processes and what streams are affected?

What are the influences and relationships between water quality and other ecosystems processes in the watershed?

What is the management objective for water quality the analysis area?

What management actions (restoration, maintenance, protection, etc.) could be undertaken that would maintain and/or restore water quality within the analysis area? (refer to Section IV-Recommendations)

REFERENCE CONDITION

Sediment Delivery

Limited reference condition information is available, consequently, quantitative estimates for sediment delivery have not been determined. There has always been a natural source component of sediment delivery to stream channels. Landsliding, debris avalanches and shallow rapid debris torrents, surface erosion after historical fires, stream channel sediment adjustments and flooding have contributed soil material. An historical landslide survey has been completed.

Water Temperature
Stream temperatures are thought to have been cooler in the past. It is known that the riparian zones contained large conifer trees shading the stream. Stream channel dimensions were different in the low gradient depositional stream types in the past, by streams being narrower and deeper and connecting with narrow to wide floodplains. Water moving downstream received less solar heating, and may have exchanged with and replaced bank stored water in lowland alluvial reaches. This effect would act as a heat pump, removing heat from the stream in a down valley direction (Beschta 1996).

Dissolved Oxygen
Although dissolved oxygen levels fluctuate with the seasons, it is thought that they were seldom below saturation. Factors including decreased stream temperatures, lack of algae, less hardwood detritus, and narrower and deeper streams storing larger volumes of in-channel water, are thought to be characteristics that prevented significant oxygen reductions in stream water.

Fecal Coliform
There is not enough information to formulate a reference condition, and therefore is a data gap.

CURRENT CONDITION

Sediment Delivery
The main process delivering sediments to tributary streams include debris avalanches and shallow rapid debris flows, from first and second order steep headwall channels. This delivery mechanism yields a high volume of sediments and debris, but occurs on an infrequent basis. Avalanche initiation areas include undisturbed vegetated headwalls on shallow to deep fine textured soils, old roads and over steepened landings above channels. Usually soils must already be in a saturated condition and a rainfall event exceed four inches or more in a 24-hour period for significant initiation to occur.

Natural source areas contributing sediment to streams include steep hillslopes and headwalls above first order channels. Figure III.8-2 shows probable initiation or failure sites based on a model output using the infinite slope equation. Channel sources of sediment loss include banks and beds in some Rosgen stream types; particularly A5, A6, B5, B6, F5 and F6. Flooding can cause soil loss and delivery to streams and extend the stream network to capture unconsolidated colluvium in hollows. Exceptionally heavy rainstorms (1 in 50 to 1 in 100-year events), like the one in February 1996 that affected from the Siuslaw River northward, cause widespread landsliding directly into streams of all sizes.

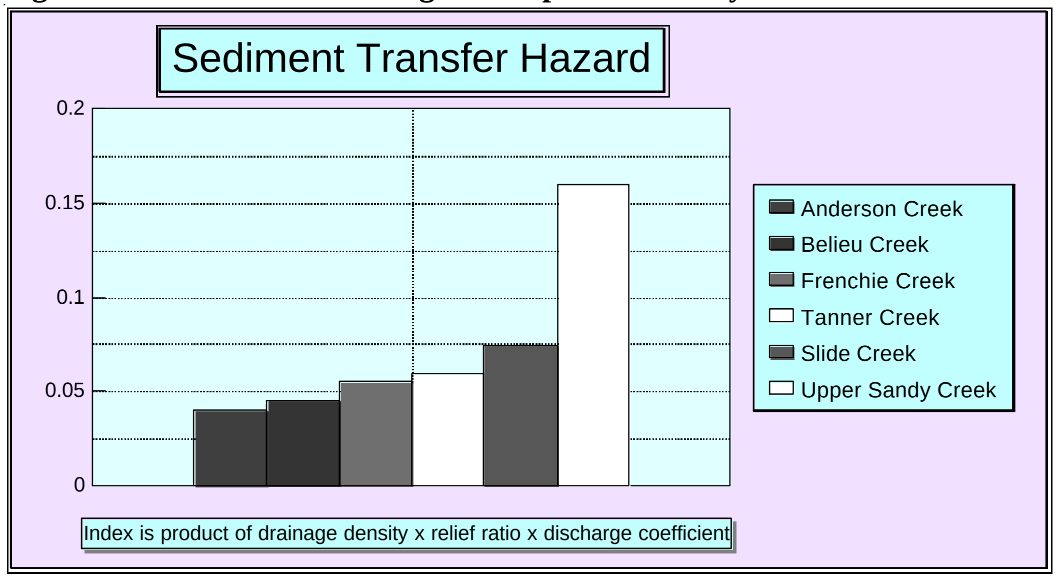
Sediment sources due to forest management, especially forest roads, is well documented. Delivery of sediment to streams can occur for 1-2 years along intermittent channels after broadcast burning, until vegetation reestablishes the site. This results in a large amount of fine sediment input that may take several years for the stream system to flush out.

The higher stream discharges that occur several times a winter, or extreme events that occur infrequently, carry the majority of the sediment load. However, Figure III.2-3 shows that high flows which carry the greatest sediment loads occur less than 5% of the time.

Watershed recovery in terms of reduced sediment yield, after a major storm event is fair to good. No quantitative estimates are available, but streams tend to clear up in 2-5 days as stream flow levels decline.

A sediment transfer hazard was determined for the high gradient, high energy streams (Geier et al. 1995). High energy streams include Anderson, Belieu, Frenchie, Tanner, Slide, and Upper Sandy Creeks. The sediment transfer hazard represents both the transport efficiency of the streams and the bankfull runoff of the drainages. The bankfull flow is closely associated with the 2-year flood event. Figure III.4-1 shows sediment transfer hazards with increasing risk.

Figure III.4-1 Streams with High Transport Efficiency



Depositional streams include Middle and Lower Sandy Creek, the Middle Fork Coquille River and limited flats along the lower reaches of the other streams. These stream types are low gradient pool/riffle C and F Rosgen type streams and have the highest risk for sediment deposition. Aggradation by sediments can reduce pool space, and change the size distribution of substrates toward the finer particles. Aggradation can cause channel widening. This can lower the habitat quality of stream reaches and cover valuable gravel spawning beds.

Sediment may be interfering with some beneficial uses including fish and aquatic life in the pool/riffle low gradient streams. A recent survey of Sandy Creek shows high percentages of sand and silt in the stream substrate, through the lower five miles of stream (ODFW 1994). Sand and silt particle sizes in the wetted area in pools often exceeds 40% of all size classes, and 20% in riffles. An inventory in Slide Creek is currently underway.

<u>Sediment Delivery - Roads</u>

Roads alter the hydrology of drainages in several ways: increased surface runoff from compacted roadways because of reduced infiltration rates, interception of subsurface water by cut slopes, and more rapid routing of water to stream channels via road ditches and culverts. In essence the ditch system may operate much like an extended stream network. All of these effects tend to result in increases of annual yields, low flows and peak flows.

Old roads, natural surface roads, improper road drainage, and runoff from landings and other compacted areas are source areas for sediment delivery to stream channels. In average or drier years, dirt roads are probably the greatest source of fine sediments to streams during a typical rainy season. The fines (silt and clay) move as suspended sediment rather than as bedload. Sands and gravels (bedload) usually do not travel far in road side ditches due to low water volumes and velocities. Excess fines from roads should only be a potential problem during and immediately following heavy rainstorms and only if the sediment actually reaches a stream. If water from the road surface and ditch line filters through 50 to 100 feet or more of vegetation before reaching a stream, most of the sediment will drop out.

Within the analysis area less than 3 percent of the BLM road system has natural surfacing, while at least 16% of the private road system is natural surfaced. The surfacing on 78% of the private road system is not known, but could be assumed that a high percentage of these roads are also natural surfaced. As most of these roads are inadequately maintained and lack a vegetative cover, they could be sources of sediment.

Failed culverts along Slide Creek Road and Frenchie Creek Road are an additional source of sediment (see Section I-Erosion). In addition to the road fills on top of the culverts beginning to erode, soil is washing away at the culvert outlet, where the outlet end was not located on resistant material. Deep ditchlines along the Frenchie Cr. road were observed due to inadequate spacing and placement of the original culverts. Culverts along the Sandy Creek Mainline Road were inventoried in 1994 and several which were found to be rusting through the bottom were replaced under the 1995 "Jobs-in-the-Woods" program to correct erosion problems.

<u>Water Temperature</u>
Streams in southwestern Oregon are known for their relatively high summertime temperatures, but it is not clear whether this is related to a latitudinal gradient, high solar radiation loads, low flows, or other related factors (Beschta et. al. 1987). Monitoring of stream temperatures during the drought of 1992 did not show a strong correlation between maximum stream temperature and elevation (Oregon Forest Industries Council 1993). It is known that direct daytime heating of stream water, from lack of shade, during critical summer months when the incoming solar radiation load is high is a principal factor to explain increased temperatures. It is also known that temperatures increase in a downstream direction.

Elevated water temperatures have been noted throughout the Sandy-Remote drainages, although actual recorded data is quite limited. High temperatures are attributed to loss of riparian vegetation providing shade, extremely low flows and changed morphology with poor functioning of stream channels. Based on BLM's 1994 temperature monitoring data, lower Sandy Creek from the mouth to rivermile 5 was listed on ODEQ's 303(d) list of water quality limited streams. The seven-day rolling maximum temperature exceeded the basin criteria of 64 ° F for several periods during the summer. Temperature monitoring information is shown in Table III.4-1 and station locations are shown in Figure III.6-2 (pg.110). Violations of State standards were noted at station 1; other upstream stations 2-4 including ones draining BLM administered lands, did not exceed standards. Station 3 was higher than the daily maximum basin standard, but did not meet the required continuous 7 day maximum temperature. BLM collected temperature data at these stations in 1995; but it exists in raw form and has not been checked nor analyzed.

Table III.4-1 BLM 1994 Temperature Monitoring Summary for Sandy Creek

Streams	Seasonal Max.	Date	Seasonal Min.	Date	Delta T	Date	7 Day Max.	7 Day Min.	7 Day Delta T	Days >64E	Seasonal Max. 64E
Station 1	69.3	7/ 7/94	51.7	6/15/94	11.2	7/ 6/94	67.2	58.9	8.3	29	5.3
Station 2	61.2	7/21/94	51.0	9/ 8/94	4.7	7/ 6/94	60.0	57.6	2.4	0	0
Station 3	65.9	7/21/94	50.6	9/14/94	8.6	7/19/94	64.5	56.9	7.6	11	1.9
Station 4	62.7	7/21/94	50.9	9/14/94	5.4	7/ 7/94	61.1	58.	3.1	0	0

Definitions:
Delta T - Highest value of daily difference between max. and min. for the season
7 Day Max. - Average value of daily maximums for the highest seven consecutive 7 days
7 Day Min. - Average value of daily minimums for the same 7 days
7 Day Delta T - Average of the daily difference between max. and min. for the same 7 days
Seasonal Max. 64E - Number of degrees seasonal max. is above 64E F

Note: Stations 1 - 4 were located in Sandy Creek at River mile 0.5, 1.5, 3.5, and 6.0 respectfully

Results from 1992-1993 data at an ODEQ ambient stream monitoring site at rivermile 0.2 on the Middle Fork Coquille, west of the analysis area, show temperatures exceeding basin criteria, during the summer months (ODEQ 1994b).

Dissolved Oxygen

The amount of oxygen dissolved in water can affect water quality and aquatic habitat. The solubility of oxygen in water is inversely proportional to temperature and directly proportional to atmospheric pressure. Most tributary streams are at saturation for their given elevation and temperature, because of stream tumbling and aeration, except for low stream flow periods. Dissolved oxygen levels may be reduced due to microbial decomposition of organic matter, known as biochemical oxygen demand. During late summer/fall, when flows are low, dissolved oxygen may fall below saturation due to the addition and decomposition of leaf litter from riparian forests (Taylor and Adams 1986).

Dissolved oxygen in lower Sandy Creek and the Middle Fork Coquille River in the gentle gradient stream reaches declines to low levels during late summer low flow. Results from an ODEQ ambient stream monitoring site at rivermile 0.2 on the Middle Fork Coquille, west of the analysis area, show dissolved oxygen exceeding basin criteria for 18% samples taken (ODEQ 1994b). Decomposition of algae in these valley bottom stream types is suspected of depressing oxygen levels.

Fecal Coliform

Results from an ODEQ ambient stream monitoring site at rivermile 0.2 on the Middle Fork Coquille, west of the analysis area, show fecal coliform levels exceeding basin criteria for 9% of samples taken (ODEQ 1994b). Sources for elevated fecal coliform levels may be from unrestricted cattle grazing in lower Sandy Creek, other tributary streams, or seepage from sewer systems near Remote, OR., just east of the analysis area. Private residence's setback requirements for septic drain fields were narrower in the past (ODEQ 1996b).

SYNTHESIS & INTERPRETATION

The NonPoint Source Assessment (ODEQ 1988) shows turbidity, sedimentation, and erosion for the Middle Fork Coquille River and tributaries as a moderate problem. ODEQ has established the Coquille River as a Water Quality Limited TMDL (total daily maximum loads) stream, because pollution controls from sewage treatment plants and other point sources in the lower river below the analysis area have not been stringent enough to achieve the state's water quality standards. Non Point Source contributors are not included in the watershed at this time, nor is sediment one of the measured parameters. The 1972 Federal Clean Water Act, section 303(d), requires that stream segments that do not meet the State's water quality standards be listed. Recent 1995 clarifications by ODEQ require that the state demonstrate good cause for not listing a waterbody. Criteria have been set by ODEQ for sedimentation and turbidity. So far, no streams in the analysis area have been listed for these parameters.

Delivery of sediments and other materials will continue to provide inputs to stream channels. Debris avalanches and rapid debris flows are the primary mechanisms of channel recruitment of sediment. Sediment lodged in low order channels in debris fans is reworked downstream over a number of years. Magnitude and probability of occurrence of debris torrents is variable, depending on damaging storms, but usually with a return period of five years or greater. Roads, road drainage problem areas, compacted areas and streams in poor condition also contribute sediment to higher order streams. Annual sediment supply may be higher than historic levels, although large pulses of sediment did occur in the past. Downstream depositional stream morphology is suspected to have changed by channel widening and entrenchment, and may not be able to store excess sediment on floodplain terraces. Instead, streambed and pool filling has occurred, and may likely continue. Where entrenched streams have not widened enough for the frequent discharge to deposit sediment, it will be carried downstream to the estuaries. Large woody debris that has been removed from low order channels may have prevented sediment from being deposited in long term storage behind them, instead of routing downstream.

During high runoff conditions, sediment is being flushed into the Middle Fork Coquille river and transported to the estuaries or ocean. This results in the sediment moving through the system faster both in time and space. The addition of sediment in this manner results in the inundation of aquatic habitat with fine sediment materials. The sediment covers fish spawning areas, reducing oxygen to fish eggs and thus reducing populations. Other stream processes that are affected are the populations of macro invertebrates, riparian dependent species such as Pacific giant salamanders, and nutrient cycling processes related to the woody materials in the stream environment.

<u>Sediment Delivery - Roads</u>

Deteriorating culverts have been observed as a primary source of erosion from management activities on BLM lands in the analysis area. Many culverts' outlets along Slide and Frenchie Creek have active soil erosion and due to their proximity to the stream system maybe a point source of sedimentation. These culverts which have rusted through should soon start to affect the road fills, causing them to erode, resulting in road failure and increase sedimentation. The soils common along Slide Creek are 14F (Digger-Preacher-Umpcoos) and Frenchie Creek are 46F (Preacher-Bohannon). As these two roads were constructed in the 1960's and 1970's, culverts which were installed as part of the original construction or reconstruction are rapidly approaching the end of their useful life. It could be assumed that other roads built during this time may also contain culverts with similar problems.

In addition, improper culvert placement is resulting in higher than normal ditchline erosion along Frenchie Creek Road. The road has intercepted several streams near to where the road crosses Frenchie Creek, diverting their flow into the ditch. Poor spacing of culverts is also causing water to travel in the ditchlines for a longer distance than it should for the soil conditions. As mentioned before, the soils in this area are more erodible than found elsewhere, resulting in higher than usual sedimentation.

Given the low mileage of natural surfaced roads on BLM lands, it is felt that sedimentation from these roads is minor and very localized.

It is not known the extent to which private roads are contributing to sedimentation and therefore is a data gap. Given that most private timber company roads were built before the BLM road system, it could be assumed that these roads could be important point sources within the analysis area.

<u>Water Temperature</u>
The Aquatic Conservation Strategy and pattern of Riparian Reserves on intermittent and perennial stream channels will provide thermal control by shading the streams, except in cases of natural disturbance. Because of the lack of LWD in most all stream types, interim Riparian Reserve width's should not be reduced below 100 feet on each side of intermittent and non fish bearing perennial streams. Fish bearing perennial streams along third order and higher channels will have a 440-foot (2 site tree lengths) reserve maintained along each side of the stream. This not only provides thermal protection during the summer, but is also wide enough to influence microclimates and likely retain cooler air temperatures. Stream temperatures on private lands in lower Sandy Creek will continue to be elevated, unless streamside shade is restored.

<u>Dissolved Oxygen</u>
Little information is available to know if oxygen depletion is a problem in the analysis area. Isolated and slow-moving pools on flats within transitional tributary streams are suspected to have oxygen levels below saturation for short periods in autumn when flow is very low and leaf input is high. The wider, slow-moving sections of the lower 5 miles of Sandy Creek and limited reaches of the Middle Fork Coquille River are suspected to have oxygen levels below saturation in summer, due to increased stream temperatures, low flow, and decomposition of algae.

<u>Fecal Coliform</u>
State water quality accedences for fecal coliform have been noted in the lower watershed areas, and are thought to coincide with agricultural operations and human occupation. There is low dispersed recreation use throughout most of the drainages on BLM administered lands, so fecal coliform contribution to tributary streams is not expected.

<u>Management Objective</u>
The management objective is for clean, cool water that fully supports beneficial uses and meets or exceed Water Quality Standards for the South Coast Basin, or as amended by basin wide standards or criteria referred to in "Oregon's Criteria for Listing Waterbodies" (ODEQ 1996a). It

also includes ensuring that actions do not degrade water and meets Oregon's Antidegredation Policy. Soil and water conservation practices, implemented as a Best Management Practice (BMP) design for a project will be carried out to meet Oregon's water quality goals. The *Northwest Forest Plan FSEIS* and *Coos Bay District's 1995 Resource Management Plan Appendix D* list many of these BMP's to be routinely used in management actions.

Sedimentation is the chief parameter of concern from BLM administered lands, and has the highest probability of occurrence.

Restoring streams, including control of livestock and increasing streamside shade on private lands in lower Sandy Creek, should have positive effects on water quality by reducing fecal coliform, lowering stream temperatures and increasing oxygenated water during the summer. Source search monitoring for failed septic drain fields in the Remote area could also be done to pinpoint fecal coliform and contaminant sources.

III.5 CORE TOPIC - VEGETATION

GENERAL VEGETATION

Analysis Questions:

What is the historical array and landscape pattern of plant communities and seral stages in the analysis area?

What naturally-caused disturbances occurred in the analysis area?; how big were they?; and in what way did they form vegetative characteristics found within the analysis area?

Where and how abundant are the various natural plant communities, including old growth communities, and are any missing or represented by only small remnant populations?

Are there any special status or survey and manage plant communities in the analysis area?

What and where were the human-caused disturbances, and what impact did they have on the character and composition of the watershed?

What are the current conditions and trends of the prevalent plant communities and serial stages in the watershed (riparian and non-riparian)?

What are the influences and relationships between vegetation and other ecosystem processes (e.g., hydrologic maturity, channel stability, disturbance, species movement, soil and erosion processes, etc.)?

What is the management objective for vegetation in the analysis area?

What management actions (restoration, maintenance, protection, etc.) could be undertaken that would maintain and/or restore the integrity and productivity of the vegetation within the analysis area? (see Section IV - Recommendations)

REFERENCE CONDITIONS

Historical Array

The historic landscape throughout most of the entire Coast Range was characterized by large, similar aged patches (ranging in age from 0 to 500+ years old) on the order of many square miles. Most of these patches formed mosaics, containing scattered old-growth trees (i.e., remnant trees >160 yrs. old), patches of old-growth, and small patches of various younger age classes. At any one time, any particular subwatershed could be dominated by one seral stage, still containing components of both young and old stands. Research by Ripple (1994) calculated that 61% of all conifer Coast Range forests were in old growth condition prior to the widespread fires of the late 1840s. These fires, thought to set by early white settlers, burned approximately 35% of the Coast Range (Teensma et. al. 1991) resulting in only 43% of the forests in old growth condition.

The vegetation array throughout the Middle Fork Coquille was similar to that characterized by the entire Coast Range. For an approximate picture of landscape patterns prior to 1943 (the first year aerial photography was available), vegetation patterns were reconstructed by using FOI birth dates of residual stands (Figure III.5-1). Acknowledging the fact that the FOI may be inaccurate for these older dates, it is still evident that large stands of similar ages occurred throughout the watershed. Stands dating from around 1780 are concentrated towards the eastern third of the watershed, near Camas Valley, OR, while the more recently aged stands are concentrated in the western half. More recently aged stands resulted from a large fire in 1868 (Peterson, 1952) and appear to be the most widespread, as residual stands of this age can be located throughout the entire Middle Fork Coquille watershed. This landscape could be characterized as a large scaled, soft edged, slowly changing mosaic.

As with the Middle Fork Coquille watershed, vegetation from the 1868 fire dominated a majority of the Sandy-Remote analysis area resulting in a current abundance of trees 100-120 years old and the scarcity of older forests. Two isolated pockets of older aged stands (birth date c.1700) survived and are located adjacent to the Middle Fork Coquille River up into Frenchie Creek and in the northeast corner of Sec 1, T. 29 S., R. 10 W. These represent the oldest stands within the entire Middle Fork Coquille watershed.

The landscape was generally forested with perhaps occasional meadows. By examining existing 100-120 year old stands, it appears that their characteristics are similar to those which developed from large scale stand replacement fires. These conditions fit stand descriptions described by Franklin (1973) for mid-seral staged stands within the western hemlock zone. The percentage of Douglas-fir stems from harvested stands throughout the analysis area ranges from 75 to 90%, with a mixture of Port-Orford cedar (2 -13%), western hemlock (<5%), hardwoods (<9%), and a trace (<1%) of grand fir and western red cedar.

Harvest data from the older aged stands (i.e., where the 1868 burn was less intense) similarly confirm anticipated results from low intensity fires or underburns. Data from the stand in Sec 1, T. 29 S., R. 10 W., revealed an understory stand heavy to western hemlock (51%), with the remnant Douglas-fir comprising only 43% of the tree stems. Within another timber sale in Frenchie Creek (Sec 20, T. 29 S., R. 10 W.), Port-Orford cedar comprised an unusually large number of stems (34%), while the Douglas-fir was only 48%. The process of fire succession is well documented by Agee 1993 and this pattern is consistent with current theories about fire disturbance.

Lowland riparian areas probably contained many hardwood forests of Oregon ash, Oregon myrtle, and red alder (see Section III.5, subsection-Riparian vegetation). There were no exotic weed species, nor Port-Orford-cedar root rot (*Phytophthora lateralis*).

Naturally-caused Disturbances - Fire

Fire is assumed to be the primary disturbance which resulted in this mosaic of varied age classes throughout the Middle Fork Coquille watershed. Fires probably occurred on or about 1700, 1780, 1820, 1868 (Peterson, 1952), and 1910, based on FOI birth dates. Historically, it appears that the larger disturbances (circa 1700, c.1780, and 1868) created areas of similar aged stands covering a third or more of the 5th field watershed each time. Each fire, while large, did not consume all vegetation within their boundaries. Scattered old-growth trees, snags and downed

Middle Fork Burn map

logs (remnants), and isolated pockets of older aged stands containing these characteristics remained to create the varied mosaic. The relative abundance, condition, and distribution of shrubs, hardwoods, and conifers also varied in response to the fire severity. A mosaic of fire intensities resulted in a complex landscape with gradual transitions between stands and many complex stands with varying species compositions and differing amounts of residual stand components.

A detailed field examination of stumps and stand ages is needed to determine exact fire dates. Ripple (1994) calculated a 406-year fire cycle in the Oregon Coast Range, however, the fire frequency calculated for the Tioga Creek subwatershed for the period from 1404 to 1923 was 17 years (BLM 1996).

<u>Naturally-caused Disturbances - Wind</u>
Wind has played a limited role as a disturbance factor within the analysis area. The November 10, 1975 storm resulted in the Sandy Salvage Sale No. 77-30. However, only two of the clearcut units (totaling 38 acres) of the sale's 5 units (totaling 100 acres) were within the analysis area. The two units, located along a main tributary of Sandy Creek (T. 29 S., R. 10 W., Sec 9 & 16), have an east-west orientation. Large areas of blowdown were generally clearcut, while small isolated blowdown patches or snags were generally partially cut. Another salvage sale, East Sandy Salvage No. 72-20, clearcut 166 acres in T. 29 S., R. 10 W., Sec 14. This sale however cannot be attributed to a known storm event. No large windthrow can be attributed to the November 13, 1981 storm (see the list of storms in Appendix B-2). A small 5 - 10 acre patch located along an exposed high ridge in T. 29 S., R. 10 W., Sec 21, resulted from the December 12, 1995 storm.

For this part of the Coast Range, storms generally originate from the south and southwest. The orientation of Sandy Creek itself is north-south which probably results in more wind firm stands along the main creek area. Areas of windthrow are generally located along east-west orientations, which parallels the current understanding of how wind storms affect windthrow (Andrus and Froehlich 1992). However, the analysis area is within a rain shadow and appears to be protected somewhat by the ridge systems (Bone Mtn., Eden Ridge, White Mtn.) to the south.

<u>Fine scale disturbance</u>
Fine scale disturbances like individual tree and patch blow down, low severity fire, insects, disease, drought, and soil movement create small gaps throughout the landscape. In addition to these agents, riparian vegetation is also modified by flooding, stream bank erosion, and saturated soils. These disturbances are present, but a determination of their frequency or scale was not conducted due to their limited large scale impacts. Most stands were influenced by combinations of all these disturbance processes, occurring at varying frequencies and unevenly distributed throughout the stand and the subwatershed. These natural processes created a landscape which provided vegetative complexity and diversity at a variety of scales.

<u>Insect and disease</u> - Laminated root rot and black stain disease can kill patches of sapling and pole size trees. Bark beetles usually kill trees already weakened by other agents like drought, fire or disease, but may become epidemic following extensive fire or blowdown. Other pathogens and insects attack trees in this analysis area but none are known to cause significant mortality in established stands.

Land slides - Land slides usually affect only small areas at a time but the severity of that disturbance can be very high. Landslides result in the loss of the top soil and organic layer at their point of origin. Where they come to rest, they bury developed soil profiles with material that is predominantly subsoil and fractured rock. In extreme cases, all soil is lost down to bedrock. The loss of the organic layer and top soil to landslides sets back plant succession, and favors pioneer species. Red alder is particularly successful in occupying slide tracks and deposits because of its small winged seed facilitates long distance disbursal, rapid juvenile growth, and ability to fix nitrogen. From the stand point of red alder's regeneration strategy, fresh road cuts and fills provide the same conditions produced by landslides. Landslides that reach the creek can deliver structural material (woody debris, and boulders), gravel, fine sediment, and fine organic matter.

Floods - Like landslides, floods affect only a small part of the landscape but it too is a significant process. Flooding can kill or damage vegetation by burying small plants under sediment and breaking plants with brittle stems. Flooding affects the species composition on the flood plain by killing plants that do not tolerate saturated soils. This frees growing space for those plants that have mechanisms to survive saturated soil conditions or can regenerate on sediment deposits.

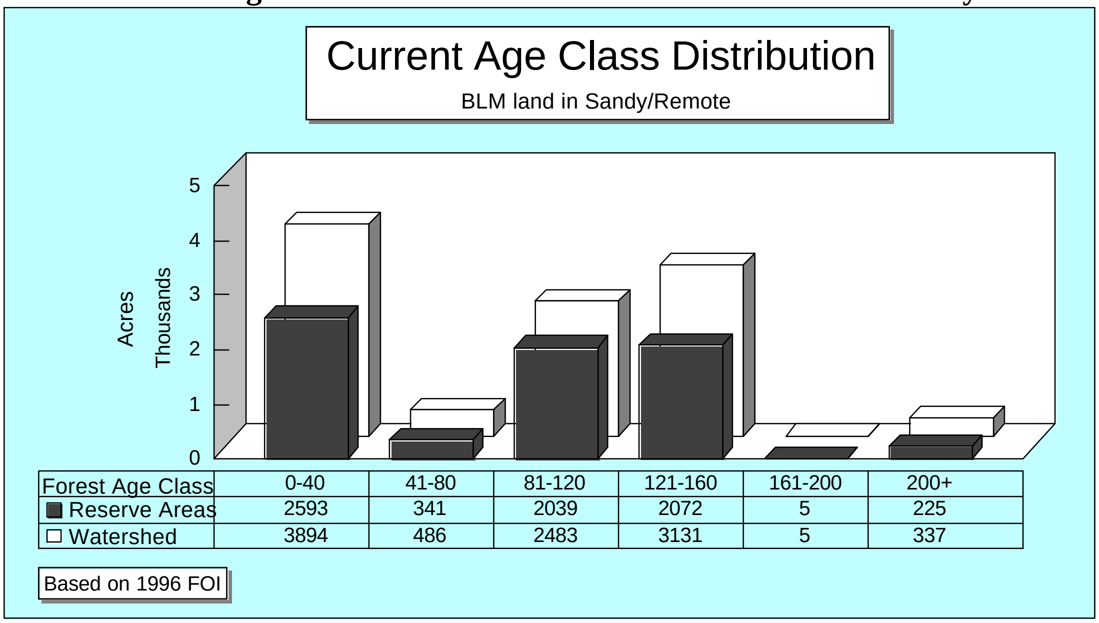
CURRENT CONDITIONS

As interpreted from 1943 aerial photos, the majority of the analysis area was in a natural condition. A small amount of timber harvest activity was concentrated on the northern most edge adjacent to the Weaver Ridge Road, along Sandy Creek itself, and as salvage from the 1930's fires adjacent to Highway 42. Snag falling contracts, snag free corridors, and mortality salvage all occurred on the District from the 1940s through the 1970s. These practices reduced snag and down log habitat, particularly along roads and adjacent to harvest units (Hootman 1995). See Sandy Creek Watershed Analysis (BLM 1995) for a detailed reconstruction of European settlement and subsequent timber harvest in the Sandy Creek subwatershed. Human activities have altered 72% of the analysis area since 1943, resulting in a significant change in the age composition of plant communities. General information on the present distribution of age classes throughout the analysis area can be found in the Section I - Characterization and Figure I-10.

Across the landscape (including private land), early seral habitats are more common than late-seral habitats and there is little difference among watersheds in the Middle Fork Coquille River system (adjacent watersheds look fairly similar). The historical large blocks of similar aged stands have been replaced with a highly fragmented pattern characterized by hard edges (distinct contrast between adjacent stands) and small patch size (on the order of 40 acres). During the 1970's and 1980's the Bureau restricted clearcut size to approximately 40 acres, and attempted to distribute their locations so that adjacent areas were at least 10 years old. The belief at that time was that this practice would benefit wildlife due to the resultant edge-effect (Thomas 1979). On private lands, larger areas were clearcut areas, and clearcuts were often adjacent to the previous years harvest, resulting in larger tracts of land uniform in age.

Abundance
Age distribution on BLM lands is characterized by large acreages of predominately two general age groupings. As shown on Figure III.5-2, 38% of the BLM acreage is in young stands (<= 40 years of age), while 54% is in mature stands (81-160 years). The age class distribution in reserve areas mirrors that of the watershed as a whole.

Figure III.5-2 Current age class distribution of forests on BLM land in Sandy-Remote



Forest Age Class	0-40	41-80	81-120	121-160	161-200	200+
Reserve Areas	2593	341	2039	2072	5	225
Watershed	3894	486	2483	3131	5	337

Old growth forests, those > 200 years of age, currently occur on only 2% of the analysis area. On private land, cursory aerial photo interpretation suggests that only 3% has never been harvested (Table III.5-1) and the majority of that is not old growth forest; therefore, old growth forest habitat is virtually absent from private land. Private land is primarily managed for timber production or livestock grazing and will likely never provide significant amounts of late-successional or old growth forests.

Some introduced species occur from past management practices, ranging from noxious weed species (see the following subsection on Noxious Weeds) to grasses and forbs. The latter were introduced as part of soil stabilization measures associated with road construction and forage seeding of some harvest units.

Special Status Plant Communities
Special status plant species are those that are of concern because of their rarity and/or threats. These species include those listed as Endangered or Threatened under the Endangered Species Act, federal candidates, state listed species and BLM sensitive species (Bureau sensitive, Bureau assessment, and Bureau tracking). Each list of species has its own management requirements.

Currently there are no known locations of federally listed, federal candidate or BLM sensitive plant species, nor is there potential habitat for any federally listed or candidate plant species within the watershed. Habitat for other sensitive plant species is unknown at this time.

The Northwest Forest Plan/Coos Bay RMP identifies several fungi and plant species for which various levels on management were prescribed. Based on field surveys of various sites, no locations of Strategy 1 (Manage Known Sites) species are known to occur in the analysis area.

<u>Human-caused Disturbances- Logging</u>
Logging has had the most impact on vegetation since the 1950's. To date, 39% of BLM's ownership within the analysis area has been clearcut while 97% of private ownership has been harvested (Table III.5-1). Aerial photography reveals that private landowners harvested nearly 2/3'rds of their ownership in the 1950's, while harvest from BLM lands has been relatively stable each decade since the 1960's.

Table III.5-1 Logging Disturbance by Decade

BLM Ownership (10,365 ac)			Private Ownership (13,617 ac)		TOTAL (23,982 ac)
Decade	Acres harvested	% of BLM ownership	Acres harvested	% of PVT ownership	
1940's & 1950's	102	1%	9200	68%	39%
1960's	897	9%	2360	17%	14%
1970's	704	7%	660	5%	6%
1980's	1337	13%	550	4%	8%
**1990 to 1992	954	9%	480	4%	6%
Totals	3994	39%	13250	97%	72%

Even remnant stands on BLM lands have been affected. Based on the earliest documentation of timber harvest available on the District, salvage of dead or dying trees during the mid-1960's to early 1970's occurred throughout Sections 1, 2, 3, 9, 15, 16, 22, 23, and 34, T. 29 S., R. 10 W. In addition, it was common practice on timber sales during the 1970's to fall or harvest dead trees within 200 feet of roads or the boundaries of clearcut units. Therefore, most snags and down logs within remnant stands in Sandy Creek area have been removed. A portion of Sec. 9, T. 29 S., R. 10 W. was commercially thinned under the Sandy Bear-Pen Thinning Sale No. 70-47. Although no records are available for Belieu Creek, aerial photos and stand characteristics indicate that one or more salvages occurred on BLM lands in this area following fires of the 1930's. The remainder of the Remote subwatershed (e.g., Slide and Frenchie Creeks) does not appear to have been similarly affected.

Because of the early harvest of private lands, logging of the second rotation of timber has begun, most notably in Sec 28, T. 29 S., R. 10 W. This pattern is expected to continue for private ownership as the timber stands reach 40 to 50 years of age. As part of their forest management practices, herbicide application to control noncommercial species generally occurs within the first 15 years following harvest. Fertilization of older stands may also occur.

Human-caused Disturbances- Fire

There have been several human-caused fires within the analysis area since 1931 based on documentation from the Oregon State Board of Forestry. Typically, these fires were small (1000 acres or less) and incendiary in origin (Appendix B-1), as evident by the concentration of fire activity adjacent to Highway 42 (Figure III.5-3). All of the fires occurred between August to October and were more frequent during the 1930's, as these were drought years. There is documentation of numerous fires attributed to lightning, but due to intense fire suppression efforts, they were limited to an acre or less in size. However, there is little documentation of lightening causing wide scale fires in the coast range. The more probable cause of fires occurring in the mid 1800's is European settlers (Zybach 1993).

Human caused fire map

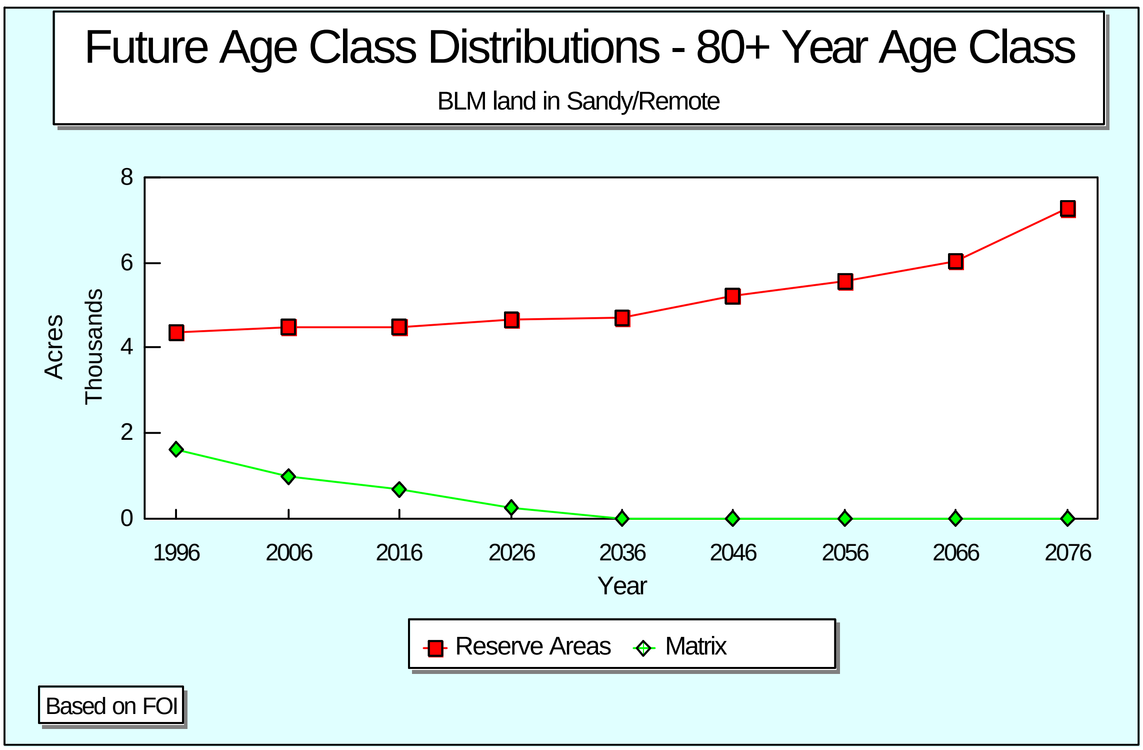
SYNTHESIS & INTERPRETATION

General discussion the effects of natural and human disturbance processes on vegetation are found in Appendix B-5. How these processes specifically influence the analysis area is discussed below:

<u>Trends</u>

Under current projected BLM harvest rates (harvesting approximately 1/6 of GFMA lands in an area per decade in 60 year rotations), within 40 years all harvestable stands will be <60 years of age. Therefore minimal harvest (commercial thinning) would probably take place for a few decades to allow sufficient acreage of trees to mature past age 60 before regeneration harvest resumes (Figure III.5-4).

Figure III.5-4 Future age class distribution of 80+ year old forests on BLM land in Sandy-Remote.



Age classes reach a rough equilibrium within about 50 years with 59% of reserve areas > 160 years of age and all GFMA areas < 60 years of age.

Figure III.5-5 - Future age class distribution of 160+ year old forests on BLM land in Sandy-Remote.

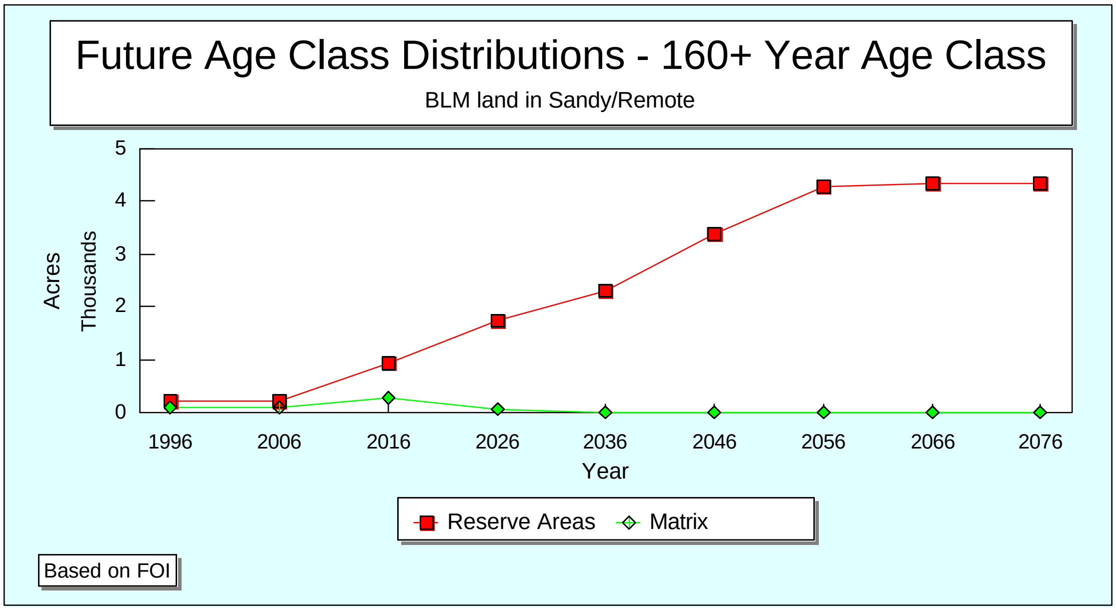
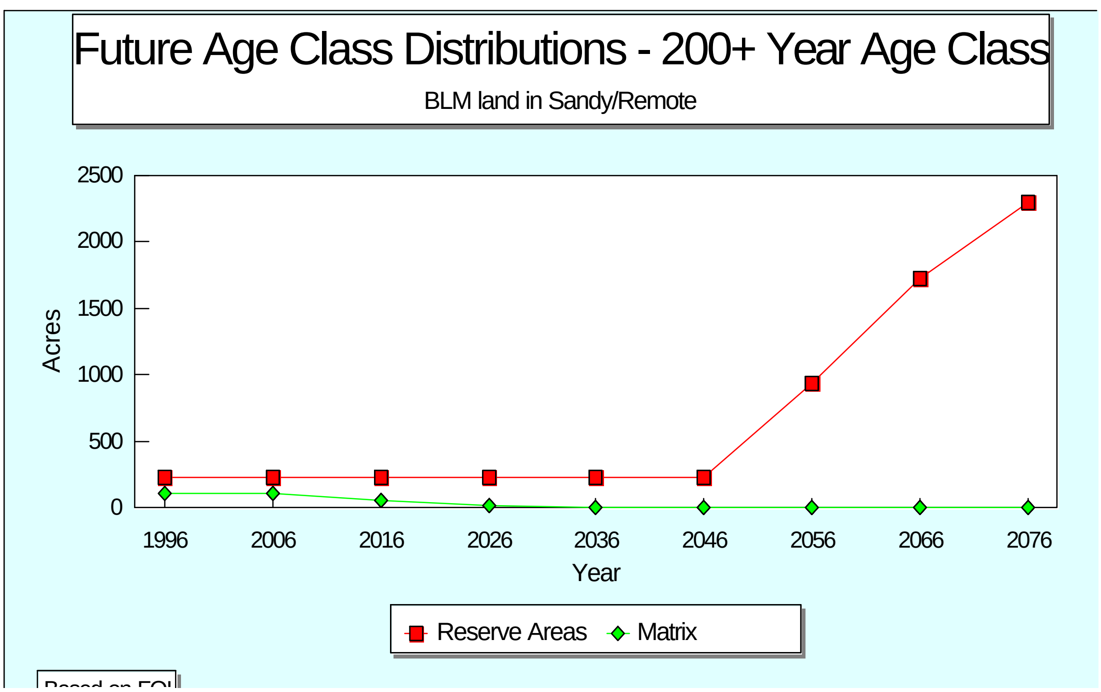


Figure III.5-6 - Future age class distribution of 200+ year old forests on BLM land in Sandy-Remote.



Private lands and those BLM managed lands designated as GFMA will be maintained in an early to mid-seral stage (40-80 yrs. old) depending upon ownership and timber market conditions.

Influences and Relationships

Even with the trend towards removing the vegetation at regular intervals (60 year harvest cycle), it appears that surface erosion from harvesting should be within an acceptable rate, especially from BLM lands. Harvest areas rapidly revegetate with sufficient ground cover to limit surface erosion. Riparian Reserve areas adjacent to streams will act to filter out sediment (see Section III.8 - Riparian Reserve Evaluation).

It could be assumed that elevated peak flows would continue as approximately 70% of the analysis area would be harvested on a 60 year rotation. Stands less than 30-40 years of age are not up to their full evapotranspration potential (see Section III.4 - Water Quality)

The combination of fire and salvage logging of snags and down logs has greatly reduced the availability of these habitat features for wildlife (see Section III.6 - Species & Habitat).

The landscape will become less fragmented in Reserve areas as vegetation matures and the contrast between edges decreases. By concentrating harvest units in space and time, and if harvest areas mimic past natural disturbances, fragmentation also has the potential to be decreased on GFMA lands. Some edge effects will continue to result where harvest areas abut Reserves (see Section III.6 - Species & Habitats).

It is not fully understood what impact the introduction of non-native grasses and forbs has had. Some early seral species have benefitted from their presence and surface erosion has been reduced, but the long term effects on the ecosystem are unknown.

Management Objectives

With BLM's current management direction it is not likely that historic patterns of vegetation can be restored on non-Reserve designated lands. GFMA lands will be managed for timber production and early seral species. This will be accomplished by mimicking natural disturbance patterns, vegetative species mixes, and key structural components (snags, down logs). These objectives may also provide some benefit for mid and late-seral species.

Within Reserve areas, it is desirable to strive towards late-successional forests with old-growth characteristics.

RIPARIAN VEGETATION

Analysis Questions:

What is the historical array and landscape pattern of riparian plant communities and seral stages in the analysis area?

What processes, such as disturbance, topology, are important in shaping/maintaining riparian vegetation?

How much of the riparian overstory is presently dominated by shrub, hardwood, conifer, and mixed hardwood/conifer vegetation types?

Is there adequate potential for recruitment of large wood to streams and riparian areas?

Is there adequate riparian canopy closure to maintain desirable stream temperatures for aquatic organisms?

What components of riparian areas are important to maintain water quality for aquatic and riparian dependant species?

What are the influences and relationships between vegetation and other ecosystem processes (e.g., hydrologic maturity, channel stability, disturbance, species movement, soil and erosion processes, etc.)?

What are the current conditions and trends of the prevalent plant communities and serial stages in the watershed (riparian and non-riparian)?

What is the management objective (desired condition) for riparian vegetation in the analysis area?

What management actions (restoration, maintenance, protection, etc.) could be undertaken that would maintain and/or restore the integrity and productivity of the riparian habitat within the analysis area? (see Section IV - Recommendations)

REFERENCE CONDITIONS

Historical riparian vegetation may be classified into two, somewhat distinct communities, the lowland and upland types.

The lowland riparian community would have inhabited floodplains and floodplain terraces along the mainstem Middle Fork Coquille River, and the lower three miles of Sandy Creek up through T29S, R10W, Sec. 22. Historical accounts suggest that, at the time of first settlement, these areas were dominated by mixed hardwood stands of myrtle, maple and ash, with widely dispersed cedar (Stickroth 1992, Wooldridge 1971, Hermann 1959). This mixed hardwood forest formed a nearly complete canopy above the stream channel. Periodic flooding (as reported by BLM 1993) caused by heavy rainfall events, or water backed up by large debris jams (including areas affected by beaver), frequently raised the water level out of the stream channels, and onto floodplains. The structural complexity of stream channels and floodplains provided abundant overwintering habitat for salmonids and many other animals.

The upland riparian community was associated with the higher gradient, hillslope constrained tributaries, and higher terraces that were periodically, but not frequently, inundated during floods. The earliest available aerial photographs (1943) and local historical accounts indicate that the overstory of the upland riparian community was dominated by Port-Orford-cedar, western redcedar, western hemlock, and Douglas-fir, with a dispersed mixture of hardwoods (Wooldridge 1971, Beckham 1990, BLM 1993). The steep slopes and upper terraces were generally dominated by conifers, and the narrow floodplains were mostly dominated by hardwoods. Topographic and vegetative shading, except in burned areas, formed a nearly complete canopy formed over stream channels. There were probably always narrow bands of red alder immediately adjacent to the stream, where frequent high flows precluded the establishment of longer lived hardwood and conifer species.

CURRENT CONDITION

Riparian Overstory & Processes

All of the land along the lower reaches of Sandy Creek, where historical vegetation was of the lowland type, is now owned by private individuals. Since the early 1900's, all of the lowlands in Sandy Creek have been cleared of vegetation, and most of the land is now used for grazing and crops, or is covered with shrub thickets. This has resulted in loss of canopy cover above the stream channel in the lower three miles of Sandy Creek. Nearly all large woody debris has been removed. As a result, the stream has become entrenched, so that the floodplain is rarely inundated. This has also resulted in the lowering of the water table in the floodplain (see Section III.3-Stream Chanel).

Canopy cover above the Middle Fork Coquille River has been reduced for most of its length within the analysis area. Although BLM-administered riparian lands on the north side of the Middle Fork Coquille are dominated by large conifer trees (Sec 29, T. 29 S., R. 10 W.), red alder is predominant on the south side of the river where the agricultural and road-related disturbances have occurred. Red alder is also the dominant hardwood species on floodplains and landslide-impacted slopes adjacent to the river.

The upland riparian vegetation community has been changed from its historical condition. Red alder is more abundant in upland areas than it was, particularly in riparian areas where roads have been constructed, and where harvest with ground based systems has occurred. In addition, clearcut harvesting (with no or inadequate riparian buffers) and repeated salvage of trees and logs have eliminated many large mature and old-growth trees and logs from riparian areas. Within the uplands, there are reaches where the stream gradient is low and hardwood-dominated floodplains naturally occur adjacent to streams. An example of a hardwood-dominated stand within the upland riparian community type can be found across from Camp Remote (Sec 2, T. 29 S., R. 10 W.), where a large flat (old floodplain) is now dominated by very large, old bigleaf maples. As in the past, narrow bands of red alder are still predominant immediately adjacent to streams, where frequent high flows preclude the establishment of longer lived hardwoods and conifers.

BLM conducted a riparian vegetation inventory covering approximately 17 miles of the 29.5 miles of 3rd order and larger streams in the Sandy Creek subwatershed (Table III.5-2). Other drainages in the watershed were not inventoried. Land managed by the BLM, commercial timber company lands, and individually-owned private lands each comprised approximately one third of the area inventoried. A 100-foot wide area was inventoried on both sides of the stream

Table III.5-2 Riparian overstory bordering 3rd order and larger streams in the Sandy Creek subwatershed (shown as % of ownership).

	PASTURE	SHRUBS	CONIFER[1] Dominated	HARDWOOD[2] Dominated	MIXED
BLM	-	7	32	30	31
TIMBER COMPANY	-	3	10	50	38
PRIVATE	16	-	11	46	28
COMBINED	5	3	18	41	32

[1] overstory canopy cover comprised of ≥70% conifer, including conifer plantations, and young, mature, and older stands
[2] overstory canopy cover comprised of ≥70% hardwood

Eighteen percent of all the inventoried land had an overstory dominated by coniferous trees. Only a small portion of this overstory was mature conifer - all on BLM land. Agricultural land represented 5% of the area surveyed, and virtually all agricultural land in the Sandy Creek subwatershed was located on the broad floodplain located adjacent to the lower four miles of the stream. However, because only a 100-foot wide area was inventoried on each side of the stream, the actual proportion of riparian area being utilized for grazing and agriculture is higher than 5%. These results reflect a highly disturbed state.

<u>Potential for Recruitment of Large Wood</u>
In a separate analysis using FOI data, stands >160 years were mapped (Figure III.8-6, pg.138). Although FOI stand ages are not always accurate, this analysis can indicate areas, that with little management, may have a relatively greater potential to contribute large wood to stream channels and riparian forests.

<u>Riparian Canopy Closure</u>
The 1992 aerial photographs and informal field reviews indicate that canopy closure, necessary to protect and maintain desired stream temperature, exists over most of the fish-bearing reaches, except within the lower three miles of Sandy Creek and above the mainstem Coquille River.

SYNTHESIS & INTERPRETATION

Both lowland and upland riparian communities have been significantly altered by processes associated with logging and agriculture. For example, much of the timber harvested was adjacent to stream channels because early logging practices relied on streams to transport logs. In the era of splash damming, riparian vegetation was denuded to facilitate log transport. As logging technology and transportation improved, timber harvest proceeded into progressively steeper 1st and 2nd order streams, leaving few riparian areas untouched. Agriculture has also had a tremendous impact on riparian areas. Since the 1860's, when settlement began along Sandy

Creek, a large portion of the flood plain has been cleared for pasture and crops. Removal of vegetation and large wood near streams, banks and headwalls, delivers excess sediment to streams, and eliminates or reduces the recruitment of new woody debris for decades to centuries (Swanson and Lienkaemper 1978, Swanson et. al. 1976, Grette 1985).

Over the last century, standing and downed conifers have been removed from, and roads built along, most of the primary streams and riparian areas. Because red alder responds to heavy disturbance activities, such as logging and road building, many riparian areas have been converted from mixed conifer stands with a hardwood understory to red alder-dominated stands with a shrub understory. Now alder is establishing on conifer sites where the soils have not been damaged through shear volume of seed. Encroachment of roads into the riparian zone has also resulted in loss of area available for riparian vegetation.

Within the assessment area, the removal of parental trees has left insufficient amounts of conifer seed within some hardwood dominated riparian areas. Even with seed present, conifer reestablishment becomes difficult as germination and growth are greatly inhibited by the shading effects of alder and salmonberry. The loss of large coniferous trees from the riparian areas also means the loss of large woody debris recruitment over the next several centuries. Conifers can live for several hundred years and, once they fall, can take another 100 years to decay. Red alder stands, on the other hand, are short lived (approximately 70-100 years), and once fallen only provide woody habitat for 10-15 years.

In the past, periodic flooding, caused by heavy rainfall events or water backed up by large debris jams and beaver dams, frequently raised the water level out of the stream channels, and onto floodplains. The structural complexity of the floodplains provided excellent overwintering habitat for salmonids and many other animals. This process also enhanced groundwater recharge. However, because many stream channels have become entrenched, and nearly all woody debris in floodplain areas was removed, the floodplain is now rarely inundated (only once in the last 30 years). This probably resulted in the lowering of the water table in the floodplain. Changes in flood frequency, intensity, and duration, combined with changes in the water table have undoubtedly affected the riparian plant and animal species composition.

Anderson and Belieu Creeks are naturally more sediment rich than other drainages in the analysis area due to the geologic parent material and are more prone to aggradation of stream channels. As sediments are deposited in low gradient stream reaches, the channel tends to widen, thus increasing the disturbance area immediately adjacent to the stream. This may also influence the relative abundance of hardwoods and conifers in riparian areas.

Many high gradient 1st and 2nd order streams are naturally prone to debris avalanches and debris torrents (see Section III.1-Erosion Processes). The gentle gradient streams that are the recipients of this material typically have many steep tributaries contributing debris avalanches. Therefore, these streams have a higher frequency of disturbance that is associated with the deposition of debris avalanche material. This higher disturbance frequency is one of several factors that causes 3rd and larger order streams, and some 2nd's, to have greater hardwood and lesser conifer components at a given distance from the stream compared with 1st order streams.

Other factors affecting the relative abundance of conifer verses red alder close to streams are the width of the area influenced by the riparian microclimate (generally wider next to larger streams and in more protected areas, narrower on smaller streams and on south to west aspects) and availability of a seed source. The relative abundance of a conifer seed source is greater on sites with less frequent disturbance or where the time since the last disturbance is longer than the life expectancy of red alder.

Beavers also have the ability to greatly modify riparian vegetation if beaver population levels, stream geomorphology, and vegetative conditions are favorable. In the past, beavers may have played a greater role in shaping riparian communities and aquatic habitat in lower Sandy Creek, where channel gradient was low, and where hardwood species dominated active floodplains.

Upland riparian communities were periodically influenced by both stand replacement fires and lower intensity underburns. These fires generally result in conifer stands while the intensity influences the species composition. Stand replacement fires often resulted in a temporary abundance of large woody debris followed by long periods of no recruitment.

Trends

The information presented above indicates that the character of the riparian vegetation has changed over the past century. Given time and sufficient protection, the natural process of succession and maturation will restore some of the historical conifer components. Because it is necessary to meet the land management needs of a variety of landowners, it is unlikely, however, that the condition and function of the watershed will return to its historical state. Where insufficient conifer seed sources exist, or alder-salmonberry stands inhibit establishment of conifers, silvicultural manipulation may be required to restore riparian areas to desired conditions. In addition, the restoration of large conifers as a component to hillslope processes will provide large wood to the stream channels in the future.

The extensive riparian survey completed by BLM on Sandy Creek in 1994 indicated that there were several contiguous reaches in T29S, R10W, Sec. 11, 14, and 15 where silvicultural treatments would be appropriate. In 1995, two sites (30 acres total) of upland riparian area were silviculturally treated to release existing conifers from hardwood overstories, and reestablish conifers on what was historically conifer-dominated sites. With continued site maintenance, these sites should be restored to their historical conditions (conifer-dominated overstories with a hardwood component immediately adjacent to the stream and in the understory). These projects will help establish the connectivity between other contiguous reaches.

Management objectives

The management objective for vegetation within Riparian Reserve areas is to create or maintain habitat which supports late-successional, riparian, and aquatic species.

For lowland riparian areas, it is to achieve the historic vegetation assemblages and conditions to the extent possible. Specifically, lowland riparian areas would be a mixed hardwood stand, with scattered conifers, extending on both sides of the stream to the edge of the floodplains and flood prone terraces. This vegetation would form a canopy over the stream channel with $\geq$ 60% crown closure on the Middle Fork Coquille River and 75% crown closure on Sandy Creek. The understory would include a lush profusion of native shrubs and herbaceous species. This condition would help restore natural hydrologic function, provide bank stability, enhance water quality and fish habitat, and support beaver and other native wildlife species.

For upland riparian sites, it is to maintain an average of 75% canopy cover over streams, with a dominance of conifer and scattered hardwoods in the overstory, and an average age of $\geq$ 160 years. On BLM lands, this vegetation would extend on both sides of the stream in accordance with the Riparian Reserve widths specified in the ROD, as modified in accordance with a riparian reserve evaluation (Section III.8-Riparian Reserve Evaluation). On private lands, this vegetation would extend on either side of the stream channel in accordance with the State Forest Practice Rules (ODF 1994). The understory would include a mixture of native shrub species, varying with site conditions. This condition would help to restore the natural sediment budget and hydrologic function, provide a reliable source of large woody debris, enhance water quality and fish habitat, and support native wildlife species.

PORT-ORFORD CEDAR

Analysis Questions:

What is the current distribution and level of infestation of POC root-rot in the watershed?

What is the potential for the continued introduction and spread of the disease?

What ecological processes would be altered should POC be lost, or populations greatly reduced in the ecosystem?

What management actions (restoration, maintenance, protection, etc.) could be undertaken that would reduce the spread or help prevent the introduction of the disease into new areas?

REFERENCE CONDITION

Port-Orford cedar (*Chamaecyparis lawsoniana*) has historically been a component of the forests within the analysis area. It comprised approximately 2 - 13% of the forest stands and was found in a codominant to understory position.

CURRENT DISTRIBUTION

Phytophthora lateralis, Port-Orford cedar root rot, was unintentionally introduced in the northwest as early as 1923, causing in some cases, 100% mortality. The spores of the fungus, being highly mobile in water, travel downstream infecting previously uninfected areas. Spores also are transported by construction equipment, vehicles, man and animals.

Although no systematic survey has been done to date to identify all locations nor the severity of the disease, Figure III.5-7 shows infected locations based on visual observations.

POC infection map

SYNTHESIS & INTERPRETATION

Potential

The disease will continue to be spread throughout the watershed given the climatic conditions and mechanical methods of spread. As water transports the spores over the soil and into the stream network, the disease will spread downslope from current infected sites.
Humans, animals, equipment, and vehicles transport infected soil to uninfected areas. Areas adjacent to roads and harvest units are common points of infection. Some spread occurs from root contact between trees.

Current thought is that there appears to be some variation in resistance to the disease by individual POC trees. The level of infection within an area appears to be correlated with resistance.

Ecological Processes

Because of the prolific seeding capability of POC, the tree species will continue to be present in the ecosystem,though that population maybe at a reduced level. It is though that western red cedar may occupy a similar ecological role as POC, however due to the low percentage of western red cedar, it is doubtful that the western red cedar will replace it ecologically. Reduction from historic levels will undoubtably have some affect on stand diversity and species dependant on this tree.

Management Objectives

The overall objective is to maintain the presence of POC within the watershed by reducing the rate of spread of infection, isolate and treat infected areas, and prevent infection of healthy areas.

NOXIOUS WEEDS

Analysis Questions:

What is the current status of the spread of the noxious weeds in the analysis area?

What is the potential of noxious weeds to impact and spread within the analysis area?

What management actions (restoration, maintenance, protection, etc.) could be undertaken that would reduce the spread or help prevent the introduction into new areas?

REFERENCE CONDITION

There were no known noxious weeds or exotic species prior to white settlement of the area.

CURRENT STATUS

Currently there are five species of noxious weeds known to occur within the analysis area. These include; scotch broom (*Cytisus scoparius*), French broom (*Genista monospessulana*), gorse

(*Ulex europeaus*), tansy ragwort (*Senecio jacobaea*), and Klamath weed (*Hypericum perforatum*).

The species of most concern are the two broom species and gorse, which have the ability to rapidly overtake and dominate an area. Typically these species occur along roads and in disturbed areas, but in some cases have the ability to spread into recently reforested areas, where they compete with young conifer stock. Two broom species occur primarily along roads, with the greatest concentration along lower Sandy Creek road, Highway 42, and other major spur roads where land ownership is both public and private (Figure III.5-7). There are two isolated locations within Sandy Creek where gorse has been found and extensively treated. Some control efforts of the broom species have occurred on BLM lands.

Tansy ragwort and Klamath weed are present but in relatively low numbers. These species occur along roads. They are currently controlled by biological agents (cinnabar moth for tansy ragwort and flea beetles for Klamath weed) and appear to be at acceptable minimum population levels.

SYNTHESIS & INTERPRETATION

All these species are considered noxious weeds since they are non-native, introduced species and have the ability to out compete and eliminate native plant species by competing for water, sunlight, soil nutrients, and space. Indirect effects of these species may reduce some wildlife populations (if the infestations become large) by creating less desirable forage and elimination of habitats. Tansy ragwort and Klamath weed are known to be poisonous to domestic livestock and possibly wildlife. These weeds, once established, can remain on site for many years.

Gorse and the broom species are especially tenacious as their seeds can remain viable in the soil for up to 70 years. Even after they have been removed or out competed by developing forest stands they can reappear when an area is logged. An example would be in a reforested area where scotch broom is established. As the forest stand develops, the scotch broom will eventually be shaded out. When the area is logged in the future, the scotch broom will quickly dominate the area as seeds will germinate in response to the disturbance and subsequent site preparation.

Potential

These noxious weeds are dispersed through continual spread from colonized sites and seed transport by human activities. Similar to the spread of Port-Orford Cedar root rot, humans spread the seeds via vehicles, equipment, or livestock grazing activities.

Since there are existing populations of noxious weeds especially scotch and french broom and gorse, the likelihood of these species to spread throughout the watershed, if unchecked, will continue to occur. The main areas for spread will occur primarily on roads. If these populations increase, it increases the likelihood of spreading into reforested areas and undisturbed plant communities. The two broom species are the main concern. As these species spread the costs of control efforts greatly increases and become less effective.

The other species of noxious weeds will continue to persist but probably at minimum population levels acceptable to land managers as there are biological control programs to balance to spread.

Management Objectives

The ultimate goal would be the complete and total removal of noxious weeds and take the necessary measures to prevent their reintroduction. However, minimum populations of these species kept in balance by biological control agents would be acceptable.

III.6 CORE TOPIC - SPECIES & HABITATS

TERRESTRIAL HABITAT

<u>Analysis Questions:</u>

What was the historical condition, pattern, and distribution of key habitats in the watershed?

What is the <u>current</u> condition, pattern, and distribution of key <u>habitats</u> in the watershed?

How have management activities and natural processes changed the character of their habitats?

What is the current open <u>road density</u>, and how does it compare with goals from the RMP?

What is the <u>function</u> of the analysis area <u>within the larger 5th field watershed</u>?

What function does the analysis area serve in respect to retaining the minimum 15% of late-successional habitat within the 5th field watershed?

What are the <u>influences and relationships</u> of key habitats with other ecosystem processes in the watershed?

What is the management objective (desired condition) for the wildlife habitat in the analysis area? How should habitat types be arranged (spatially and temporally)?

What <u>management actions</u> (restoration, maintenance, protection, etc.) could be undertaken that would maintain and/or restore the integrity and productivity of the wildlife habitat within the analysis area? (refer to Section IV - Recommendations)

REFERENCE CONDITION

Refer to Section III.5-Vegetation for a description of historical and current stand conditions, including age-class distributions.

CURRENT CONDITIONS

The current landscape is characterized by hard edges (distinct contrast between adjacent stands) and small patch size (on the order of 40 acres). The stands are even aged, homogenous, and contain few remnant trees. Across the landscape (including private land), early seral habitats are more common than late-seral habitats and there is little difference among watersheds in the Middle Fork Coquille River system (adjacent watersheds look fairly similar). The area is still generally forest but with lowland meadows, agricultural, and pasture land. The primary disturbance is timber harvest which is a frequent and catastrophic stand replacement event. From a landscape perspective, the land is a fine-grained, hard-edged, rapidly changing mosaic. Exotic plant species are common (see Section III.5-Vegetation). The large stand replacement fires around 120 years ago resulted in a preponderance of trees 100-120 years old and a scarcity of older forests. There are relatively few snags and down logs because of past snag falling contracts and salvage activities.

Vegetative Complexity

On the Coos Bay District, systematic forest inventories needed to accurately evaluate the abundance and distribution of key vegetative and structural forest components have not been conducted. As a result, only a general analysis of forest complexity and its effects on wildlife can be presented at this time. These inventories need to be conducted to facilitate more detailed future analysis.

The majority of the area (72%) supports second growth plantations harvested since the 1940s. Conventional methods of logging, site preparation, regeneration, and stand maintenance do not mimic the natural disturbance processes thought to have maintained this landscape prior to Euro-American settlement. The result is a vegetatively and structurally simplified landscape.

The remaining 28% of the analysis area supports a combination of small mid and late-successional forest patches, found almost exclusively on BLM administered lands. From a habitat perspective, these stands are vegetatively and structurally complex, containing canopies of much greater volume and habitat complexity than the single storied, uniform canopies typical of many plantations. These complex stands support a greater abundance and diversity of birds, bats, rodents, invertebrates and other species which forage, roost, or reproduce in the canopies. However, the small size of these patches may limit their value for some species.

Late-successional Forest Habitat

Several wildlife species of concern (Table C-2, Appendix C) prefer to use old growth forest habitat. LSRs and other Reserve areas are expected to provide old growth habitat for associated species in the long term; however, in the short term, many of the Reserve areas do not currently contain late-successional forests. Table I-4 indicates that the majority of BLM lands in the analysis area contain young stands <=40 years of age or mature stands 81-160 years of age. Old growth forests, those > 200 years of age, currently occur on only 2% of the analysis area. The age class distribution in reserve areas mirrors that of the watershed as a whole. On private land, cursory aerial photo interpretation suggests that only 3% has never been harvested (Table III.5-1) and the majority of that is not old growth forest. Private land in the analysis area is primarily managed for timber production or livestock grazing and will likely never provide significant amounts of late-successional or old growth habitat.

There are 3,399 acres of LSR/MMRs and, although 72% of this is potentially late-successional forest habitat (≥80 years of age), only 4% of the LSR/MMRs likely functions as old growth habitat (≥160 years of age). With so little old growth habitat, this LSR/MMRs probably does not function, or only marginally function, as old growth forest habitat reserves. This impaired function is supported by the limited nesting success of the two spotted owl sites within the LSR/MMRs experienced in 1990-1995. Therefore, late-successional habitat in the GFMA adjacent to these Reserve areas can help carry this function until the Reserve areas mature. The oldest stands in the analysis area (Secs.1& 29, T. 29 ., R. 10 W.) and among the oldest residual stands in the entire fifth field watershed (approximately 400 years old based on nearby stumps) are not in LSR/MMR land allocation.

Snag/Down Log Habitat

In natural forests of the Oregon Coast Range, snag and down log abundance was highest in stands which had recently experienced a severe fire. Mid-seral stages are expected to have decreased amounts of snags and down logs, but both would increase as the stand matures because the trees in the regenerating forest were too small to contribute (Spies et. al. 1988). Table III.6-1 shows mean numbers of larger snags and down logs found by Spies et. al. (1988) in the Coast Range.

Table III.6-1 Numbers of snags/acre and volume of down logs/acre (all decay classes) in naturally regenerating stands in the Coast Range (from Spies et. al. 1988).

	Young (40-70 yrs old)	Mature (80-120 yrs old)	Old Growth (200-525 yrs old)
# snags/acre >20 in. dia. and 14 ft tall	1.6	2.8	4.0
volume of down logs/acre (ft^3/ac)*	1101	1730	3260

*Note - the minimum down log retention levels for hard logs (decay class 1 and 2) from the RMP equates to 167 ft^3/ac.

The analysis area faces a shortage of snag habitat because of the minuscule acreage of older stands and past harvest, salvage, and snag falling contracts in the 1940s-60s. This shortage is supported by field surveys of the area where approximately 1.7 snags > 10 inches dbh/acre were found in representative mature stands (see Table C-3, Appendix C).

Cursory down log surveys in potential harvest units (generally mature stands 80-160 years of age) found an average of 2372 ft^3/ac, 89% of which were in soft decay classes (class 3+). Similar surveys in recent clearcuts found almost no down logs (see Table C-4 Appendix C). Survey results must be viewed with some caution, however, as sample sizes may have been too small in some areas and the analysis program may still contain problems.

Rocky Habitats

The Sandy-Remote analysis area is unique among most subwatersheds within the Middle Fork Coquille watershed in the amount of cliff and rocky outcrop habitat available. Figure III.6-1 shows the three main cliff formations as well as other smaller rocky outcrops. Several species including bats, raptors, and woodrats utilize these habitats for roosting, nesting, or resting. The larger cliffs at the north end of Sandy Creek and the southeast end of Slide Creek contain some ledges and pockets inaccessible to mammalian predators which hold low to moderate potential as nesting habitat for peregrine falcons and other cliff-nesting raptors. Based on some limited field surveys, many of the smaller formations contain at least one or two deep cracks that could be used by bats and also contain other protected ledges or cavities that could be used by other wildlife for resting. Talus areas provide habitat for invertebrates, amphibians, sharp-tailed snakes, among others.

special habitat map

Landscape Pattern

Landscape patterns incorporate the ecological ideas of fragmentation, edge effects, refugia, and connectivity. The analysis area is highly fragmented and probably contains little interior forest habitat. Fragmentation has been identified as an important threat to biodiversity (see Noss and Cooperrider 1994).

Reserve, or refugia, areas function as centers for repopulation of adjacent habitats, and can even support populations for relatively immobile species such as small mammals, invertebrates, and herps and are especially important for species associated with late-successional forests.

Habitat connections between riparian and upland areas, between refugia sites within the analysis area, and between adjacent watersheds are important in order to accommodate movements of less mobile species such as small mammals and herps and to allow stepping stones for more mobile species moving between the large LSRs. Large, contiguous forest habitat connections are difficult to maintain in the fragmented federal/pvt ownership pattern in the analysis area. Nevertheless, smaller scale connections exist between upland and riparian habitats and across adjacent sections of federal land. Habitat connections are interrupted by areas of unsuitable habitats such as harvest units or roads.

Road Density

The current road density for the analysis area averages 3.46 miles/mile^2. The density of roads on BLM lands is slightly higher at 3.57 miles/mile^2 (Table D-1, Appendix D). The open road density north of the highway is currently 3.2 miles/mile^2.

As a result of the Sandy Creek Watershed Analysis, 6.5 miles of roads in Sandy Creek were closed with earthen barriers (tank traps) or gates (one road) in 1995 to limit traffic. Subsequent monitoring of the barriers found that people occasionally drove vehicles around some of the earthen barriers and the gate has been consistently left opened. The location of permanent barriers appears to be critical to its effectiveness in blocking traffic.

SYNTHESIS & INTERPRETATION

Vegetative Complexity

Managed plantations and landscapes have much lower vegetative and structural complexity than natural forests. These even-aged plantations are typically dense, containing trees more evenly spaced and more uniform in diameter, age and height than natural forests (Spies and Franklin, 1991). They have closed, uniform canopies with few gaps, and trees or snags from the previous stand are scarce or absent. Natural processes occasionally result in dense uniform stands, but more often, natural stands retain a great deal of variability, and substantial habitat complexity.

The goals for management of GFMA allocated lands include providing habitat which supports species associated with early and mid-seral forests, and maintaining suitable conditions for dispersal of late-successional associated wildlife species. Both of these objectives require maintaining and/or restoring vegetative and structural complexity of managed plantations, enabling them to provide the diversity of habitats required to maintain native ecological communities suitably distributed across the landscape. To the greatest extent possible, regeneration and silvicultural prescriptions should mimic the timing, intensity, variability and scale of natural disturbance processes appropriate to the location, rather than focusing on maximizing uniformity and commercial yield. Stand disturbance regimes and the resulting vegetative characteristics are strongly influenced by factors such as aspect, slope, topographic position, elevation, vegetation communities and past disturbance history. These factors should be used to development site-specific stand management and timber harvest prescriptions.

Late-successional Forest Habitat and Function

The analysis area contains a small LSR (RO260) which lies between two large LSRs (RO261 and RO 255). Its small size and location only allow it to function to facilitate movements of late-successional wildlife species between the larger LSRs and to support populations of relatively immobile late-successional species. The majority of habitat needs for wildlife associated with late-successional forest habitats are met with the LSR network; however, analysis at the subwatershed scale is still appropriate to ensure both functions can be met at that level. The current lack of old growth habitat, including in the small LSR forewarns of potential short-term vulnerability. The region-wide LSR network should accommodate the long-term needs of these species. The critical point is in the next few decades while harvest of some existing late-successional habitats continues in the GFMA before similar habitat characteristics (broken and decayed trees, down logs, snags, etc.) have the chance to develop in LSRs. This results in a net decreased availability of these habitats until LSRs begin to develop late-successional habitat characteristics.

With only 2% of the analysis area containing old growth (>200 years of age), the habitat function for old growth dependent species will be lacking until old growth habitat characteristics develop, particularly in the Reserve areas. Significant acreage of forests will not enter the 200+year age class for 60 years (Figure III.5-6). As one half of existing old growth habitat is in the GFMA, it is likely that these stands will be harvested within the next 40 years, resulting in a net decrease of late-successional habitat (Section III.3-Vegetation and Figures III.5-5&6). Of particular concern is the Sandy Creek portion of LSR RO260 which contains no forests >160 years of age based on FOI.

Table III.6-2 Age Class Distribution on LSRs.[1]

Forest Age Class	Acres	Percentage
0 - 20	638	17%
21 - 40	189	5%
41 - 80	226	6%
81 - 120	1913	52%
121 - 160	623	17%
161 - 200	95	3%
200 +	0	0%
Total	3684	100%

[1]Includes the entire LSR, including a small portion outside the analysis area.

Retention of late-successional forest in the GFMA surrounding this LSR could bolster late-successional habitat values in the LSR by providing additional habitat for these species until habitat conditions improve in the LSR. This would require deferring harvest in these areas up to 50 years or adjusting land use allocations to permanently support the LSR. Table III.6-2 shows age class distributions for the largest LSRs in the analysis area.

A management objective for late-successional habitats is to maintain key existing late-successional habitats, particularly those adjacent to the LSR/MMRs, to help support habitat value in the LSRs and other reserve areas until late-successional forest characteristics develop in the reserve areas. Facilitating development of late-successional forest characteristics in reserve areas is also important. Mid-seral stands in Sec.21, T.29 S.,R.10 W. were examined for potential treatments to encourage late-successional forest characteristics, but treatments seemed unnecessary at this time.

Influences and Relationships
The availability of old growth and other late-successional forest habitats is influenced by past management activities such as timber harvest and snag-falling contracts, natural disturbances such as fire and windthrow (see Section III.5-Vegetation), and succession.

Function towards retaining 15% late-successional habitat
Both the Northwest Forest Plan and Coos Bay's RMP require the retention of late-successional forests in fifth field watersheds "in which federal forest lands are currently comprised of 15 percent or less late-successional habitat". Late-successional forests are those seral stages that include mature (80 to 159 years old) and old-growth classes (160 years and older)(S&G B-1). The highest priority for retention should be the older age classes on those lands which have a 'reserve' designation (i.e., Late-Successional Reserve, Riparian Reserve, Administratively Withdrawn Reserve), followed by GFMA & Connectivity land use designations.

Table III.6-3 Late-Successional Habitat Acreage - Middle Fork Coquille Watershed

Land Allocation	Middle Fork Coquille (62,764 total BLM acres)			
	0 - 79 yrs	80 - 119 yrs	120- 159 yrs	160+ yrs
LSR & MMReserves	7329 (11%)	2639 (4%)	1212 (2%)	4797 (8%)
Riparian Reserves*	1830 (3%)	500 (<1%)	1028 (2%)	60 (<1%)
other withdrawals	743 (1%)	788 (2%)	658 (1%)	300 (<1%)
CONN	3340 (5%)	1183 (2%)	1506 (2%)	626 (1%)
GFMA**	21,494 (34%)**	5,845 (9%)**	4,824 (8%)**	2002 (3%)**
Totals	34,736 (55%)	10,955 (18%)	9,228 (15%)	7,785(12%)

* This figure reflects the Riparian Reserve acres within the Sandy-Remote analysis area ONLY. The accuracy of the data in the HYD coverage precludes calculation of RR acreage on this large a scale.
** This figure includes acres of Riparian Reserves within the GFMA allocation outside of the analysis area.

Based on FOI data, the acreage of late-successional habitat within the Middle Fork Coquille fifth field watershed is shown in Table III.6-3 above. The table shows that at least 11,982 acres (19%) of the BLM administered lands within the watershed is 80 year age class or older on 'Reserve' designated lands. It is important to note that this figure does not include all of the Riparian Reserves acres, only Riparian Reserve acreages from within the analysis area. Within the analysis area, Riparian Reserves comprises 49% of BLM administered lands. Assuming that this figure is somewhat typical for the remainder of the Middle Fork Coquille watershed, then an additional

10% of BLM's acreage might fall into this 80 yr+ reserved category.

FOI acres and the percentage of late-successional forest within the Sandy-Remote analysis area shown below in Table III.6-4.

Table III.6-4 Late-Successional Habitat Acreage - Sandy Remote Analysis Area

Land Allocation	Sandy-Remote (10365 total BLM acres)			
	0 - 79 yrs	80 - 119 yrs	120- 159 yrs	160+ yrs
LSR & MMReserves	952 (9%)	1484 (14%)	815 (8%)	148 (1%)
Riparian Reserves & other withdrawals	1982 (19%)	555 (5%)**	1256(12%)**	82 (<1%)**
CONN	-	-	-	-
GFMA	1446 (14%)	443 (4%)	1059 (10%)	112 (1%)
Totals	4380 (42%)	2482 (24%)	3130 (30%)	342 (3%)

** The acreage within Riparian Reserves is calculated from an edited HYD coverage which allows for this calculation. This acreage does not account for additional streams which will be located upon field reviews or minor modification of riparian reserve widths on intermittent streams.

As shown above, it presently contains 4,341 acres in a Reserved designation of 80 yr+ stands, which comprise 42% of BLM lands. A direct comparison of this 80 yr+ reserved acreage to that present in the Middle Fork Coquille watershed cannot be made until Riparian Reserves acreages are calculated for the Middle Fork Coquille.

Snags and Down Logs

Snag and down log abundance has declined dramatically throughout the landscape over the last 50 years. The availability of these structures is influenced by past management activities such as timber harvest, salvage, and natural disturbances (or lack thereof) such as fire and windthrow (see Section III.5-Vegetation). Without major changes to the current Forest Practices Regulations, snag and down log abundance is likely to remain very low compared to natural stands on private and state lands in the foreseeable future. Although snag and down log abundance will be greater on BLM lands, it is also likely to remain low on GFMA lands compared to natural stands.

Snags

Currently, snag abundance is probably far below 40% population levels on most early, mid, and late-seral BLM lands in the analysis area (see Table C-3, Appendix C). The Snag Recruitment Simulator model (Marcot 1991) suggests that approximately 2 hard snags per acre, 11" or greater DBH, distributed throughout the landscape are necessary in order to provide sufficient hard snags in the present and soft snags in the future (see Table C-5, Appendix C). Table C-6 in Appendix C shows snag levels necessary to support various population levels. The model further suggests critical snag shortages in the near future unless additional snags are created through management (results located in Table C-5, Appendix C). Even with aggressive snag creation efforts, short-term shortages of soft snag habitat are probably unavoidable because it takes 19-50 years for a hard snag to become a soft snag, decay class 3+ (Cline et. al. 1980).

The District RMP directs that at a minimum, snags be retained sufficient to support cavity nesting species at 40% of potential population levels throughout the GFMA. It will take at least 60 years (one harvest rotation) to eventually meet the 40% population level on GFMA lands, if snag creation efforts are limited to harvest units. It is possible to hasten the attainment of the 40% population potential goal on GFMA lands by either managing for >40% population potential in harvest units or creating snags on other GFMA lands before they are subject to regeneration harvest. Even if these levels are eventually achieved throughout the GFMA, actual cavity nester population levels on the landscape will likely be much lower, due to the lack of snags on intermingled private lands.

Snag abundance is also probably critically low on reserve lands and will continue without aggressive snag creation efforts. The current lack of hard snags (and therefore, future soft snags) creates a situation where it will be impossible to meet snag density goals for both hard and soft snags for at least 19-50 years.

A management objective is to actively strive to meet snag density goals on GFMA and reserve areas by managing for >40% population potential on harvest units when possible and by creating snags in other suitable areas not yet scheduled for harvest. Forested Reserve areas should be managed for 100% population potential. Forty percent population potential equates to approximately 2 hard snags/acre (it takes 2 hard snags/acre now to provide sufficient soft snag habitat in the future); 100% population potential equates to approximately 6 hard snags/acre (see Table C-6, Appendix C).

Location of snags is also important. Preliminary radio telemetry data on bats suggests at least some species may preferentially roost in ridgetop snags. Harvest practices in the past tended to leave most wildlife trees on the edges of harvest units, but doing so precludes options for maintaining snags in a variety of topographic positions. Snags representing a variety of decay classes, topographic positions, seral stages, and distributions (i.e. large and small clumps and singly) need to be provided through time.

Down Logs

Currently, down log abundance is probably far below natural levels on most early, mid, and late-seral BLM lands and virtually nonexistent in recent harvested areas (see Table C-4, Appendix C). Future recruitment of down logs is severely limited by the current low numbers of snags throughout the area, which often turn into down logs as they age.

Although the District RMP establishes interim guidelines for down log retention within regeneration harvest units, these guidelines are considered a minimum requirement until more accurate models are developed which establish specific down log retention levels for groups of plant associations or stand types. For most regeneration units harvested using the minimum retention requirements, down log volumes after treatment would likely be much lower than average values for naturally regenerated forests due to a portion of the class 3 -5 down logs being destroyed during the logging process, and probably well outside the natural range of variability. If down log creation efforts are limited to future harvest units, it will take at least 60 years (one harvest rotation) to eventually meet down log targets on GFMA lands. It is possible to hasten the attainment of down log target levels on GFMA lands by either managing to exceed target levels in harvest units or creating down log habitat on other GFMA lands before they are subject to regeneration harvest.

Down log abundance is also probably critically low on reserve lands and will continue without aggressive down log creation efforts. Because the current lack of hard snags and down logs (and therefore, future down logs) creates a situation where it will be impossible to provide adequate soft down log habitat in the future.

The management objective for down logs is to actively strive to at least meet the minimum requirements from the RMP for GFMA lands and to achieve down log abundance near natural levels from Table III.6-1 on forested Reserve areas.

<u>Rocky Habitats</u>

The management objective for rocky habitats is to ensure microclimate features are retained in areas being used by species of concern. These cliff, rocky outcrop, and talus habitats offer unique microclimates which are critical to species which use them. The surrounding vegetation, topography, geology, and hydrology all contribute to creating unique microclimates that these sites provide for wildlife. The RMP/NFP provides that occupied bat roost sites be buffered from timber harvest activities by 250 feet (interim measure) to maintain the microclimate features of the area. Many of the smaller rock formations and talus habitats have not been located and mapped so field surveys prior to land management activities are warranted.

<u>Vegetative Complexity</u>

The spatial and temporal landscape patterns of the Oregon coastal forests have changed dramatically over the last century, substantially affecting the ecological communities associated with these forests. Forest management practices have converted a landscape dominated by large interconnected patches of late-successional forest, to one dominated by young managed plantations, within which only small, isolated patches of late-successional forest remain. The intensive forestry practices and short rotations used to maximize yields have also prevented the reestablishment of vegetatively and structurally complex forest habitats on these plantations.

<u>Landscape Pattern:</u>

During the last 30 years, dispersed harvesting strategies have served to increase forest fragmentation. The extensive road network continues to act as a barrier for some species, facilitating the dispersal of many undesirable non-native plants, and further fragmenting the remaining patches of late-successional habitat. Furthermore, fire suppression and forest management treatments have altered the natural disturbance regimes, which were the primary factors shaping the landscape prior to Euro-American settlement (see Section III.5 - Vegetation and Appendix B-5).

These landscape changes have had major affects on the presence, abundance and distribution of wildlife species, populations and their habitats. Wildlife species closely associated with late-successional forests or rare habitats are the most sensitive to these changes. These species have physiological or behavioral traits which make them highly effective competitors within their respective habitats, but also limit their ability to adapt effectively to less suitable, or rapidly changing ecological conditions. These species also tend to be long-lived, with correspondingly low reproductive rates.

The management objective for BLM lands is to provide a landscape where fragmentation and edge contrast is generally decreasing and where refugia of high quality late-seral habitat is scattered throughout the area and connected by mid and late-seral habitats; reserve areas should be dominated by late-seral habitats interspersed with small areas of earlier-seral habitats with soft-edged transitions between habitats.

Fragmentation

Simple observation and comparison of historic (1943 and 1950) and current aerial photos show a landscape which has become much more fragmented with smaller patch sizes and more edge. For species such as the American marten or northern spotted owl which have large home ranges, many of the existing old forest patches are too small to support a successfully reproducing pair. Further fragmentation of late-successional habitats will continue to reduce the size of patches and create edge habitats, thereby reducing the effectiveness of their interior habitats. While most late-successional forest patches are large enough to support one or more reproducing pairs of species with small home ranges, patch size also has a major influence on key physical and biological conditions which affect habitat suitability. For example, bats select roost sites with very specific habitat characteristics that are well protected from variations in temperature and humidity. These conditions are commonly found within the interior portions of large late-successional forest blocks. However, within small patches, environmental conditions are more variable and strongly influenced by the environmental conditions of the adjacent habitats.

Edge effects can alter habitat characteristics up to 3 tree heights (approx. 600 feet) into the adjacent stand (Harris 1984), effectively reducing a circular 111 acre stand to only 30 acres of interior habitat. Landscapes dominated by edge habitats favor generalist species at the expense of others dependent on interior habitat. Birds nesting on these edges may experience higher failure rates due to predation and nest parasitism (see Noss and Cooperrider, 1994 for a discussion).

Refugia

Based upon the existing age class distribution of lands in the analysis area, at least five to six decades growth will be needed before the mid-seral stands could attain sufficient vegetative and structural complexity to function as late-successional and old growth forest habitat. In the interim, protecting the remaining refugia sites will be critical to maintaining existing populations of mid and late-successional species, and facilitating their recolonization of recovering habitats throughout the landscape.

Due to landscape and regional changes in habitat quality, abundance, distribution and disturbance frequency, habitat refugia is likely more important to the ecology of the current managed forests than they were to the natural forest landscape. The ecologically simple early seral plantations which dominate the current landscape cannot support many native wildlife species. Management plans have been modified to improve habitat conditions on federal forest lands, but successful restoration of key forest habitat components to managed forests is not assured

Habitat Connections

Connections between habitat areas become especially important for species in fragmented landscapes. Habitat connections occur at two scales: connections between large LSRs to facilitate movements of fairly mobile species such as spotted owls and marten between these LSRs; and connections between individual habitat patches to facilitate movements of less mobile species between these patches. Ultimately, the connections between individual habitat patches promote movement between large LSRs as well. Smaller Reserve areas (Riparian Reserves, small LSRs, owl 100 acre cores, TPCC withdrawals) and remaining habitat in the GFMA accommodate movements of species between large LSRs.

In the long term, connection between large LSRs should be accommodated by approximately 70% of BLM land in the analysis area (30% of all ownerships) in some form of Reserve areas (Table I-1). In the short term, nearly 40% of these Reserve areas are currently < 80 years of age, therefor mid and late-seral habitats on GFMA lands can bolster habitat connections for the next 40 years until the Reserve areas grow older (see Figures III.5- 4,5&6). Given harvest pressures though, retaining mid and late seral habitats in the GFMA by deferring harvest for 40 years is unlikely; therefore the emphasis should be on deferring harvest as long as possible on the areas which contribute most to habitat connectivity. (See discussion on spotted owl dispersal habitat under the following spotted owl interpretation/synthesis subsection).

Maintaining connections between individual habitat patches will depend on minimizing fragmentation of existing connected habitats in the GFMA and Reserved allocations. Riparian Reserves on intermittent streams are particularly important for maintaining these connections because they often connect upland with riparian habitats and, together with perennial stream reserves, form continuous corridors through BLM lands. Even though 59% of the Riparian Reserves are >40 years of age, the current fragmentation pattern of these areas does not lend themselves to form these critical connections (see Figure III.8-7, pg 139). Suitable habitat on GFMA lands can contribute to these critical connections between individual habitat patches. Riparian reserves will not receive significant additional acreage of forest > 80 years of age for 30-40 years (see Figure III.8-8, pg. 140). Habitat patches which span ridges separating subwatersheds can facilitate movements of individuals between these adjacent subwatersheds. Figure III.8-9(pg 145) shows four areas, primarily Riparian Reserves, holding potential for connectivity to adjacent subwatersheds.

Roads can block or discourage movements between habitat patches. Road density, open road density, road closure type, surface type, and right-of-way width all contribute to the barrier effect of roads to different species. Open road density is currently above goals established in the RMP and is of particular concern in the ODFW Tioga Wildlife Unit because of impacts to deer and elk. Building new road corridors into unroaded habitat can fragment those habitats and inhibit movements to a variety of species (see Noss and Cooperrider 1994 for more discussion). The combination of Highway 42 and the Middle Fork Coquille River may present a barrier to many species. Minimizing new road construction, decreasing open road density, obliterating existing roads or encouraging vegetation growth on them would decrease the disturbance and barrier effects of roads to wildlife.

Road Density

The RMP provides goals for open road density. Numerous studies suggest that some wildlife species, particularly small mammals and invertebrates, seldom cross roads - even roads that are closed to vehicles (Noss and Cooperrider 1994). Roads can also affect wildlife by encouraging harassment by vehicle traffic and increased access for legal or illegal hunting. These effects have been particularly well documented for large mammals such as elk (Wisdom et al. 1986). Roads can also provide a travel path into interior habitat for edge associated species.

Pope and Anthony (In Press) noted that vehicle traffic on secondary roads was greatest during fall hunting seasons. Even short, dead end spur roads received an average of 171 vehicle trips/month. In a telemetry study of elk in the Coos Bay District, Pope and Anthony (In Press) found that elk avoided areas within 164 feet of roads and poaching accounted for 50% of the elk mortality.

While all closed roads, including gated roads, are considered closed for purposes of open road density calculation, the location of closed roads and the type of closure can dramatically affect their impact to wildlife. For example, closing a road which is paralleled by a road remaining open obviously does little to reduce the effective road density. Similarly, the type of device used to close a road has a direct correlation to its effectiveness. A gated road which continues to receive significant administrative use or because gates are left open also does little to reduce harassment to wildlife. For analysis purposes, some assumptions can be made as to the projected vehicle use levels for the various types of road closures. They are:

Decommissioned Roads: Those roads with a permanent barrier (tank trap) and left in an “erosion -resistant” condition would not have vehicle activity until the next commercial harvest opportunity along that road system, generally, for a 10 to 20-year time frame.

Decommissioned Roads**: Those roads with a guard rail type barrier and left in an “erosion -resistant” condition would have vehicle activity sometime within the next 3-5 years to conduct silvicultural treatments. The road would be open to traffic for up to 2-3 weeks and then closed until the next commercial harvest opportunity along that road system, generally, for a 10 to 20-year time frame.

Fully Decommissioned Roads: Those roads with a permanent barrier (tank trap) and subsoiled would similarly not have vehicle activity until the next timber rotation, generally, for the next 30 to 40 years. It is possible that the roads will never be used again.

Temporary/Seasonally Closed Roads: Those roads with a gate would be closed to the general public, but would have administrative use. Types of administrative uses include access for surveys, silvicultural contracts, restoration contracts, or road maintenance. The road could also be used by private land owners or timber companies to access their lands.

TERRESTRIAL SPECIES

<u>Analysis Questions:</u>

What was the historical relative abundance and distribution of species of concern in the watershed?

What is the <u>current</u> relative abundance and distribution of <u>species of concern</u> in the watershed?

How have management activities and natural processes changed the abundance and distribution of these species and the character of their habitats?

What are the influences and relationships of species and their habitats with other ecosystem processes in the watershed?

What is the management objective (desired condition) for the wildlife species in the analysis area?

What <u>management actions</u> (restoration, maintenance, protection, etc.) could be undertaken that would maintain and/or restore the integrity and productivity of the wildlife habitat within the analysis area? (refer to Section IV - Recommendations)

REFERENCE CONDITION

Given the preponderance of late-successional and old growth habitats which historically occurred in the area, most of the wildlife was probably late-successional associated species or habitat generalists. Late-successional associated species are adapted to an environment that changes rather slowly or within a certain range of conditions and where disturbances do not displace them from their habitat (except for catastrophic, stand-replacement disturbances). Early successional species are adapted to capitalize on frequent, small scale disturbance patches. These species are generally fairly mobile and adapted to being displaced from their habitats (by succession). Exotic species were not introduced until white settlers moved in during the mid-1800s. See Bureau of Land Management (1995) for information on historical abundance and distribution of wildlife in Sandy Creek. Descriptions are also pertinent to the Remote subwatershed.

CURRENT CONDITION

Table III.6-5 lists the wildlife species of concern, grouped by taxonomy or habitat associations, which were considered for analysis in this document. See Table C-2, Appendix C, for a comprehensive list of species and a description of the derivation of the list of wildlife species of concern.

Table III.6-5 Wildlife species of concern

GROUP	SPECIES
Riparian/aquatic associates[1]	Dunn's salamander (*Plethodon dunni*)
	Southern torrent salamander (*Rhyacotriton variegatus*)
	Tailed frog (*Ascaphus truei*)
	Helisoma newberryi newberryi
	Lanx alta
Arthropods	Canopy herbivores
	Coarse wood chewers
	Litter & soil dwelling species
	Understory & forest gap herbivores
Bats	Big brown bat (*Eptesicus fuscus*)
	California myotis (*Myotis californicus*)
	Fringed myotis (*Myotis thysanodes*)
	Hoary bat (*Lasiurus cinereus*)
	Little brown myotis (*Myotis lucifugus*)
	Long-eared myotis (*Myotis evotis*)
	Long-legged myotis (*Myotis volans*)
	Pacific western big-eared bat (*Corynorhinus townsendii*)
	Silver-haired bat (*Lasionycteris noctivagans*)
	Yuma myotis (*Myotis yumanensis*)
Old growth forest birds	Northern spotted owl (*Strix occidentalis caurina*)
	Marbled murrelet (*Brachyramphus marmoratus*)
	Northern goshawk (*Accipiter gentilis*)
Bald eagle	Bald eagle (*Haliaeetus leucocephalus*)
Peregrine falcon	Peregrine falcon (*Falco peregrinus*)
Pileated woodpecker	Pileated woodpecker (*Dryocopus pileatus*)
Other forest birds	Band-tailed pigeon (*Columba fasciata*)
	Purple martin (*Progne subis*)
	Sharp-shinned hawk (*Accipiter striatus*)
Terrestrial mollusks	*Monadenia fidelis flava*
	Vespericola sierranus
	Prophysaon dubium
Mustelids	Marten (*Martes americana*)
	Pacific fisher (*Martes pennanti*)
Voles	Red tree vole (*Arborimus longicaudus*)
	White-footed vole (*Arborimus albipes*)
Reptiles	Sharptail snake (*Contia tenuis*)

[1] These species are discussed in the Aquatic and Riparian Species subsection.

Arthropods

This diverse species group is associated with a variety of forest layers and structures. No surveys or inventories have been conducted for arthropods. Generally they are sensitive to plant species composition, forest structure (number of layers, presence of openings, presence of snags/down logs, etc.), and disturbances. Little is known about this important species group. We do know however that arthropods hold critical roles in the function of forest ecosystems as they pollinate plants, recycle nutrients, and feed numerous insectivorous animals. The analysis area, which lies in the transition zone between the Coast Range and Klamath Mountains provinces, also holds the potential to be a transition area between different assemblies of arthropod species associated with these different provinces. Arthropod species in the southern portion of the range of the Northern Spotted Owl are generally more diverse and hold higher degrees of endemism than further north (ROD).

<u>Bats</u>

Bats are associated with a variety of habitat structures. Bats roost in buildings, bridges, rock crevices, tree cavities or foliage, and loose tree bark. Old growth forests provide higher quality roost sites than younger forests (Christy and West 1993). Foraging areas include the forest and forest openings, riparian areas, and open water. No surveys have been conducted for bats; however, the availability of many rock cliffs and bluffs which may offer roosting crevices for bats is fairly unique in the district. Only a few of these rocks have been casually surveyed for roosting bats. Most of this rock habitat has not been surveyed for bat potential.

<u>Old growth forest birds:</u>

<u>Marbled Murrelet</u>

Potentially suitable habitat was surveyed to protocol for murrelets 1995-1997. No murrelets were detected.

<u>Northern Spotted Owl</u>

The analysis area has been extensively surveyed for spotted owls. There are four site centers known. All four sites contain relatively little habitat within the average home range radius (1.5 mi in the Coast Range and 1.3 miles in the Klamath province)(see Table III.6-6). The majority of habitat is in marginal condition (mature forest). In spite of the relative shortage of prime suitable habitat, owls have nested (but irregularly) at all four sites. Two of the sites occur in small LSRs (approximately two square miles) and should evolve into long-term, stable owl sites as the habitat matures and improves. The other two sites will likely eventually "wink out" as habitat in the surrounding GFMA is cut. Habitat in reserve areas should greatly improve with the coming decades as the stands grow from mature to old-growth stands. Given the 40-60 year harvest rotation on private lands and the almost nonexistence of currently suitable habitat, private land will likely never contribute significantly to suitable spotted owl habitat. Habitat loss and fragmentation is the primary threat to spotted owl populations (Thomas et al. 1990).

Approximately 62% of BLM-administered land contains habitat suitable for spotted owl dispersal, roughly approximated as forests >=40 years of age, 46% of which occurs in interim riparian reserves (some of which are in LSRs).

Table III.6-6 Habitat conditions around spotted owl sites in the Sandy-Remote analysis area.

Owl Site	Acres of BLM Habitat within 0.7 mile radius[1]	Acres of BLM habitat within 1.3 mile radius (Klamath Province)[1]	Acres of BLM habitat within 1.5 mile radius (Coast Range Province)[1]
2184	395		1472
2189	290		1329
3167	373	956	
3169	300	876	

[1]Accepted guidelines for habitat condition around spotted owl sites state that owl sites with < 500 acres of habitat within 0.7 miles or 1336 acres of habitat within 1.3 miles (Klamath Province) or 1906 acres within 1.5 miles (Coast Range Province) are less productive than sites which exceed these conditions.

Bald Eagle

There are no documented bald eagle nesting or roosting sites. Suitable habitat may be present along the Middle Fork Coquille Rivers, but habitat surveys have not been conducted. Nests averaged 0.5 mile from water in Oregon (U.S. Fish and Wildlife Service, 1986).

Peregrine Falcon

At least three rock faces exist which hold potential as peregrine falcon nesting habitat (Figure III.6-1). Most occur on private land. One cliff on BLM land was surveyed for nesting falcons but none were detected. No other surveys have been conducted for nesting falcons and no peregrine falcons are known to occur.

Pileated Woodpecker

Pileated woodpeckers occur mainly in mature and old growth forest habitat; although younger forests may be used for foraging, particularly those with older remnant trees. They are dependent on availability of large live trees and snags and thus are sensitive to timber harvest (Marshal 1992). Many wildlife species depend directly on the tree cavities constructed by pileated and other woodpeckers. Pileated woodpeckers are particularly important as they are the only woodpecker which constructs large cavities. Pileated woodpeckers occur in low numbers throughout the analysis area.

Other Forest Birds

These birds are associated with a variety of forested habitats. Purple martins nest in cavities in recent burns or harvest units and are thus dependent on availability of suitable snags for nesting. Purple martins potentially occur but are generally very rare in the district. Band-tailed pigeons use a variety of forest habitats and feed primarily on berries and nuts. Band-tailed Pigeons occur in low numbers throughout the analysis area and seem to have experienced a general population decline from the mid 1960's to the late 1980's (Jarvis and Passmore 1992). Long-term residents of Sandy Creek mentioned noticeable declines in band-tailed pigeon populations in recent decades (interviews conducted by M. Kellett, BLM 1995). Declines may be due to reduced forage and mineral sites, reduced nesting habitat in the United States and increased pressure from agricultural interests and hunting on the winter ranges. Both species are potentially affected by pesticide and herbicide use which eliminates forage species. There have been no surveys for these species on the district.

Forest Raptors

Sharp-shinned hawks and goshawks are associated with a variety of forest types and conditions. Few surveys have occurred for these species. The sharp-shinned hawk is likely to occur in low numbers and there have been unconfirmed goshawk sightings but subsequent follow-up surveys failed to locate them. Commercial thinning operations which open up the dense young stands used for nesting by sharp-shinned hawks may potentially impact this species. Similarly, timber harvest which removes the mature and old growth forest habitat preferred by goshawks may also impact that species.

Terrestrial mollusks

No surveys for terrestrial mollusks have been conducted on the district and very little is known about their life history and distribution. Monadenia is known from sites in nearby Curry County and inhabits deciduous woodlands, often in riparian areas. Vespericola occurs near springs and is associated with old growth forests (Frest and Johannes,1993). Both species associate with riparian areas and are potentially affected by activities in Riparian Reserves and by the designation of final Riparian Reserve boundaries.

Mustelids

The marten is uncommon in the Oregon Coast Range, and populations within the state are probably in decline from habitat loss. Sightings of American marten have been occasionally documented within the district during the past 10 years, although their current abundance and distribution is unknown. Martens are typically associated with large, contiguous blocks of late-successional forest habitat which contain abundant down logs and snags. The analysis area contains a number of late-successional forest blocks which may provide sufficient suitable habitat to support marten.

The Pacific fisher has similar habitat requirements to the American marten. There are no confirmed sightings of this species documented within the Coos Bay District in recent years, but the larger blocks of late-successional habitat within the analysis area may provide suitable habitat. At the landscape level, fisher populations are probably much lower than historic levels, and are likely to continue declining until the abundance of large late-successional forest blocks increases. Both species are affected by timber harvest and salvage which remove or degrade habitat.

Voles

Red tree voles are arboreal rodents that occur in patchy distributions primarily in late-successional forests (Huff et al. 1992). They have been documented in the Slide Creek drainage and likely occur elsewhere. The white-footed vole inhabits riparian areas, particularly along small streams with an alder forest component (Maser, et al. 1981). This rare vole has been documented in the district but no surveys have been conducted. Both species are susceptible to habitat loss and fragmentation.

Reptiles

The sharptail snake is an uncommon snake found in meadows and forest edges and is most active during wet parts of the year when its primary prey, slugs, are active (Storm and Leonard, 1995). This species likely occurs in the district; however, none have been documented. No surveys have been conducted, however, there is a possibility that they occur there.

SYNTHESIS AND INTERPRETATION

Past land management practices have substantially altered the habitat conditions, wildlife populations and ecological communities of the Oregon Coast Range. Species associated with late-successional forest habitats, or key habitat components (snags, complex tree canopies, down logs, or complex stream habitats) have been most affected (see Section III.6 subsection Terrestrial Habitat). Due to these changes, populations of many wildlife species have declined dramatically, and most are restricted to small isolated habitat islands. The small size and isolation of these populations put many species and ecological communities at risk. These species of concern are influenced by disturbances to their habitats, climate, and human activities which disturb reproduction or other critical life function.

One of the major goals identified for both the NWFP and the District RMP is to protect, maintain and restore the native wildlife habitats, biological communities and ecological functions to federally managed forest lands. To accomplish these goals, conventional forest management practices must be modified to better retain and/or restore key habitat components and characteristics to the forests, and insure these components are suitably distributed across the landscape and through time. Due to the large number of native plants and animals inhabiting these forests, and the limited understanding of the ecology and habitat requirements for most species, managing forests to provide habitat on a species by species basis would be ineffective (Marcot, et. al., 1994). Instead, forest management should focus on emulating the habitat patterns and ecological processes which created and maintained the natural forest landscape. Given the current political and social environment, fully emulating all the characteristics and ecological processes of the natural forests is not feasible. For example, reintroducing large-scale catastrophic fires would present an unacceptable threat to homes and private property. However, by modifying conventional forest management practices, and properly applying these techniques across the landscape, many of the habitat components and characteristics critical to the native ecosystems can be restored to our managed forest stands. The management objective for the following species is to prevent local extirpations and contribute to recovery of special status species and other species at risk, and to maintain or restore a landscape conducive to movements of individuals among habitat patches.

<u>Arthropods</u>
Management activities which may benefit this group include limiting broad-scale slash burning and intense forest fires, limiting ground disturbance and compaction, maintenance of tree clumps in harvest units, maintaining the natural diversity of plant species, providing variety in forest structure, and maintaining high levels of snag and down log habitats (SEIS, App. J2). Management of federal land under the Northwest Forest Plan Management incorporates many of these beneficial or mitigating actions to varying degrees. Under Survey and Manage guidelines, general regional surveys were to begin for these species by FY 1996 in an attempt to learn more about their distribution and biology. To our knowledge, these surveys have not been initiated but are sorely needed to fill this information gap. Interim management guidelines recommended

in the following sections should decrease impacts to these species until regional surveys can refine our knowledge of them: Snags, Down Logs, Vegetative and Structural Diversity. Management actions on private land will likely continue to heavily impact arthropod species.

Bats

The following sections address habitat needs for bats: Riparian Assessment Module, Snags, Late-successional Forest Habitat, and Rocky habitats. Surveys for these species are needed to identify species occurrence and distribution, high activity areas, hibernaculum, and unique feeding and roosting habitat.

Old Growth Forest Birds:

Northern spotted owls

Two owl sites (MSNO 2184, 3167) are located in LSRs and are expected to continue to be occupied by spotted owls and function as long-term, stable, productive owl sites. Habitat condition in these LSRs though is currently marginal (see Late-successional forest habitat section). In spite of this, owls have been able to successfully reproduce here occasionally. As habitat condition improves, so will the stability and productivity of these sites. In the short term, these owls are almost undoubtedly using late-successional habitat in the GFMA adjacent to the LSRs, particularly in the non-breeding season when home ranges are larger. The two GFMA owl sites, while they have been productive as recently as 1994, are expected to eventually "wink out" and support only occasional occupation thereafter. Their long term function for spotted owls will be that of providing habitat for dispersing and floater individuals. The analysis area has been well surveyed for owls and additional owl sites are unlikely given the marginal condition of habitat and the current distribution of known owl sites. The region-wide LSR network is intended to accommodate the long-term survival of spotted owls. The greatest risk to owl survival is in the next few decades as the net amount of habitat decreases (see Late-successional Forest Habitat section). Mitigating that risk requires temporarily maintaining owl sites in the GFMA and retaining existing habitat in the GFMA as long as possible.

Approximately 62% of BLM-administered land contains suitable habitat (>=40 years of age) for spotted owl dispersal, 46% of which occurs in Riparian Reserves. Subtracting estimated regeneration harvest acres expected to occur in the next few year leaves approximately 56% of BLM-administered land supporting owl dispersal habitat. Assuming similar acreage of regeneration harvest each decade, 57% of BLM-administered land would support dispersal habitat 10 years from now. Approximately 71% of private land in the analysis area is >= 40 years old (probably an over estimate of private dispersal habitat). In 10 years, using projected age class distributions (from Figures III.5- 2) and assuming private land reaches an equilibrium with 33% of private land in dispersal habitat, approximately 46% of the entire analysis area would be in dispersal habitat conditions. Thomas et al. (1990) recommended that at least 50% of an area be in suitable dispersal habitat condition to facilitate dispersal of owls between large LSRs, so while dispersal habitat conditions are adequate on BLM land, dispersal habitat in the analysis area as a whole maybe inadequate. The analysis area lies in an important dispersal corridor between large LSRs to the north and south.

Marbled Murrelets

What little optimal habitat exists for murrelets has been surveyed to protocol and found to be vacant (surveyed 1995, 1996). The remainder of habitat is of marginal quality (see Late-successional Forest Habitat section). Given the lack of old growth habitat, the distance from the ocean (24-32 miles), and the absence of documented activity, murrelet activity in the analysis area is unlikely in the near future and the area's contribution to murrelet recovery is minimal. Given time, murrelets could eventually begin using the area once habitat conditions improve (see Late-successional Forest Habitat section).

<u>Goshawks</u> - Goshawks usually inhabit mature and old growth forest habitats (Marshall, et al. 1992). Although the analysis area is on the edge of the species range, there were unverified sightings made in Sandy Creek in 1996. LSR blocks will provide the largest and highest quality blocks of habitat in the long term but habitat availability may be limited in the Sandy Creek LSR. The following sections address habitat needs for goshawks: Late-successional Forest Habitat, Landscape Pattern. The spotted owl dispersal habitat discussion above may also pertain to goshawks. Goshawks are significant predators on spotted owls where their ranges overlap.

<u>Bald Eagle</u>

High quality potential nesting habitat exists in Sec. 33, T. 29 S., R.10 W., above the Remote store, and in Section 29. Both areas offer old growth habitat close to the Middle Fork Coquille river. The Section 29 portion is protected in the long term by LSR designation. These two areas hold the best potential nesting habitat for bald eagle in the Middle Fork Coquille watershed east of Myrtle Point within the district (they are the largest and oldest stands closest to the river). Very little habitat probably exists west of Myrtle Point on private lands. Maintaining larger riparian reserves in Section 33 would preserve future nesting options for eagles. The Pacific Bald Eagle Recovery Plan identified habitat loss as the primary threat to bald eagles (U.S. Fish and Wildlife Service 1986). In addition to habitat needs, bald eagles require a nesting area free of unusual disturbance in order to complete their nesting cycle. The recovery plan identifies criteria for minimizing disturbance to nesting bald eagles (U.S. Fish and Wildlife Service 1986).

<u>Peregrine Falcon</u>

The following sections address habitat needs for peregrine falcons: cliffs and rock habitats. In addition to habitat needs, peregrine falcons require a nesting area free of unusual disturbance in order to complete their nesting cycle. Pagel (In press) recommends management actions and buffer zones for active peregrine nest sites in order to maintain the habitat characteristics of the site and to minimize disturbance. Cliffs in Figure III.6-1 should be surveyed for peregrine falcon nesting prior to activities which could disturb nesting (primarily timber harvest during 1 Jan - 31 Aug).

<u>Pileated Woodpecker</u>

The previous subsections address habitat needs for pileated woodpeckers: Snags, Late-successional Forest Habitat.

<u>Other Forest Birds</u>

The previous subsections address habitat needs for other these species: Snags, Landscape Patterns, Forest Complexity.

<u>Terrestrial mollusks</u>

The following section addresses habitat needs for these species: III.8-Riparian Reserve

Evaluation.

Mustelids
The previous subsections address habitat needs for these species: Late-successional Forest Habitats, Snags, Down Logs, Landscape Pattern, Forest Complexity, and Section III.8-Riparian Reserve Evaluation.

Voles
Draft survey methods and management recommendations for red tree voles were recently distributed to districts (version 1.1, received 30 Jul 96). The purpose of the protocol is to identify important habitat areas which connect LSRs, to prescribe survey methods, and to prescribe protective measures for the species where necessary to maintain connectivity between LSRs. White-footed voles are perhaps the rarest microtine rodent in North America (Maser et al. 1981), and they have been documented in the Umpqua Resource Area, near Bandon, and other areas further south within the district. They appear to associate with mature alder riparian areas (Maser et al. 1981, Oregon Natural Heritage Database). Projects which reduce mature alder riparian habitat could affect local populations or fragment what is probably an already highly fragmented distribution. (see Section III.8-Riparian Reserve Evaluation).

Reptiles
The analysis area lies just beyond the sharp-tailed snake's range, so the probability of their occurring is fairly low. Important habitat characteristics include soft down logs and stable talus in damp habitats often near forest edges or open hardwood forests (Nussbaum et al. 1983).   The previous subsections address the habitat features for sharp-tailed snakes: Down logs, Rocky Habitats.

AQUATIC and RIPARIAN HABITAT

Analysis Questions: See also, Section III.6 - Species and Habitats (subsections: Terrestrial Habitat, Terrestrial Species)

What was the historical condition and distribution of aquatic and riparian habitats (including woody material) throughout the analysis area, and how have human activities affected them?

What is the current abundance, distribution, and condition of spawning and rearing habitat for anadromous and resident fish, and how are they maintained?

What is the current abundance, distribution, and condition of aquatic and riparian habitats for other aquatic and riparian associated species (e.g., herptiles, invertebrates, beaver), and how are they maintained?

What and where are the human caused obstructions to the migration of fish or other aquatic species?

What is the role of this analysis area within the larger 5th field watershed?

What are the <u>*influences and relationships*</u> *of aquatic and riparian habitats with other ecosystem processes (e.g., sedimentation, vegetation)?*

What are the <u>*trends*</u> *in aquatic and riparian habitat condition, and what forces have the potential to reduce or limit the viability of key habitats or habitat elements (including headwater streams, large wood, habitat complexity)?*

What are the <u>*management objectives*</u> *for aquatic and riparian habitats in the analysis area (including abundance and distribution of large wood)?*

What <u>*management actions*</u> *(restoration, maintenance, protection, etc.) could be undertaken that would maintain and/or restore the integrity and productivity of aquatic and riparian habitats within the analysis area? (refer to Section IV - Recommendations)*

REFERENCE CONDITION

Descriptions and measurements of aquatic and riparian habitats useful as reference conditions have not been found and probably do not exist within the analysis area. Since the turn of the century, the majority of the watershed has been impacted by splash damming, roading, harvesting, stream cleaning, and fires, often followed by multiple salvage operations (see Section III.5-Vegetation). Reference conditions for riparian vegetation are described in earlier sections (see Section III.5-Vegetation). In addition, extensive instream and riparian stand measurements are available for several “pristine” old-growth and mature sites in adjacent watersheds including Rock and Camas Creeks (Ursitti 1991).

Large-scale aquatic and riparian habitat degradation began in the era of splash damming (1920's & 1930's) (see Section III.7-Human Uses). Much of the logging done in conjunction with splash damming in this area focused on Port-Orford-cedar, western redcedar, and Douglas-fir growing in fairly close proximity to the stream channels (riparian areas). The splash dam just below Remote on the Middle Fork Coquille River backed water up into the lower reaches of Sandy Creek, and this area was used as a log dump. Splash damming along the Middle Fork Coquille River and Sandy Creek, and stream cleaning (1960's & 1970's), removed wood and rock structure from within the stream channel, causing channel entrenchment (see Section III.4-Stream Channel) and simplification of aquatic and riparian habitats.

CURRENT CONDITION

The earliest stream habitat surveys were conducted in 1949, 1950 and 1961 by the Oregon Fish Commission (Table III.6-7). These surveys were cursory, largely anecdotal, and focused primarily on assessing potential obstacles to anadromous fish passage. Little useful information can be gleaned from these reports, except to note the abundance and locations of wood accumulations (debris jams).

Physical and Biological surveys conducted in the 1970's quantified additional habitat characteristics such as substrates and shade, and more extensive surveys conducted in the 1980's quantified large wood and cover. However, very little information from these surveys can be used to compare against the ODFW (1994a) benchmarks for “good” habitat.

The most recent and comprehensive stream habitat surveys were conducted on Slide Creek in 1996, and on Sandy Creek in 1994 (ODFW 1994b), as part of ODFW's Aquatic Inventory Project (data and summary reports on file in Myrtlewood Resource Area, Coos Bay District BLM, North Bend, OR; and ODFW, Corvallis, Oregon). These surveys were designed to be assessed in relation to the benchmark criteria (Table III.6-8). The Slide Creek survey was not complete at the time of this analysis and could not be summarized, but some elements of the 1984 BLM survey were used in the comparison with benchmark criteria (Table III.6-9).

Survey information and anecdotal information indicates the following aquatic and riparian habitat conditions and limitations in the watershed (see Section III.5- RiparianVegetation for riparian vegetation conditions):

* Fish passage into Frenchie and Tanner Creeks are blocked by culverts under Highway 101; however, spawning and rearing habitat for anadromous salmonids are limited by drainage basin size and channel gradient. Average channel gradient in the first 0.5 miles of Frenchie and Tanner Creeks are 6% and 16%, respectively. Riparian vegetation is recovering from past fires and BLM lands adjacent to the stream appear to be well stocked with young conifer trees capable of recruitment in the future.

* There is no apparent anadromous fish use in Belieu Creek upstream from the Highway 101 culvert, although basin size and channel gradient are not limiting, and there are no known barriers. Coho spawning does occur in a 200 ft. reach between the stream mouth and the culvert, and structures are in place to facilitate passage of salmon into the culvert. However, the culvert is a large and wide concrete box, approximately 200 ft. long, with a flat bottom and no baffles. This condition may prevent fish passage during winter flows, at least in some years.

* Belieu Creek is highly constrained by a private gravel road in the lower 1 mile. The road condition is poor, with numerous potholes and several small slides into the stream. The drivable portion ends at a cabin, and an unmaintained portion continues on to access BLM lands in section 25. Aquatic habitat along the constrained reach is devoid of structure, apparently aggraded with course sediments, and is in poor condition.

* On Belieu Creek, there is little potential for recruitment of large woody debris to riparian areas from private lands, as indicated by the scarcity of large conifers (>20" dbh) in the riparian areas. BLM land on mainstem Belieu Creek (NE1/4 Sec. 25, T.29 S., R.11 W.) contains sites that have sustained repeated fires, followed by road construction and one or more salvage harvests. This area contains a maturing riparian forest, and although the stand is not currently delivering significant amounts of large wood, there is potential for future recruitment of large wood to the riparian area. The aquatic area contains "good" amounts of large wood, mostly remnants from the previous old-growth stands.

Table III.6-7. Aquatic habitat surveys and inventories within the Sandy-Remote watershed, 1949-1996. Reports on file in Myrtlewood Resource Area, Coos Bay District BLM, North Bend, OR.

Stream Name	Survey Date		Survey Type	Remarks
	Yr.	Mo.		
Anderson	1975	Aug.	BLM Inventory and Analysis	Coho present to 0.5 miles; steelhead present to 0.7 miles to 10 ft. falls. Beaver dams plentiful in lower reach.
Belieu	1992	sum.	ODFW survey for juvenile coho	No coho within 1.0 mile of mouth.
	1991	wint.	ODFW random spawning survey - coho salmon	No coho salmon or redds in 1.1 mile survey near mouth.
	1977	Oct.	BLM Extensive Survey - aquatic habitat	No known obstructions; no anadromous fish from mouth to 1.4 miles.
	1961	Aug.	Oregon Fish Commission reconnaissance survey	No barriers; no coho juveniles from mouth to 1.2 miles.
Frenchie	1991	Apr.	BLM reconnaissance survey	Culvert appears to be passage barrier; limited anadromous habitat.
	1990	Sept.	ODFW reconnaissance	One adult fall chinook, eight steelhead fry, and several cutthroat 1/4 mile above mouth (north end of section 29).
	1984	Oct.	BLM stream habitat survey	High quantities of large wood.
Sandy	1994		ODFW Habitat Inventory Project	Surveyed 9.5 miles of mainstem and 7.25 miles on 9 tributaries.
	1980		BLM Inventory and Analysis (Physical and Biological Stream Survey)	Surveyed 8.9 miles of mainstem; upper limit of anadromous fish was a cascade at 7.5 miles. Surveyed 5 miles of tribs; 3 miles accessible to anadromous fish.
	1961	May	Oregon Fish Commission	Location of wood jams; all passable.
	1949 -50	Jul.	Oregon Fish Commission	Location of wood jams and logging debris; all passable.
Slide	1996	Jun.	BLM/ODFW Aquatic Habitat Inventory Project	Survey incomplete -data unavailable.
	1984	sum	BLM Aquatic Habitat Inventory	Survey 2.5 miles; falls barrier (13 ft.) to coho in section 33.
	1969	Aug.	Physical and Biological Str. Surv.	Impassable falls at 0.62 miles.
	1961	Aug.	Oregon Fish Commission	Coho found to jam 300 yds above mouth.
Tanner	1977	Oct.	BLM extensive survey	Surveyed 0.5 miles. Anadromous fish barrier (culvert) at mouth; very limited habitat.

Table III.6-8. Summary of 1994 stream habitat survey of the Sandy Creek drainage using criteria from the Aquatic Habitat Inventory Project Benchmarks (ODFW 1994a).

Benchmark Criteria	Mainstem Reaches					Tributary Reaches								
	1	2	3	4	5	A	B	C	D	E	F	G	H	FETTER
Pool Area (%)	59.9	39.1	35.6	31.8	3.9	27.1	8.1	6.9	56.6	2.7			9.1	
Pool Frequency (channel widths)	4.1	7.0	7.7	5.0	29.7	8.6	26.6	32.8	6.2	124.3			56.9	
Residual Pool Depth (m)	.52	.49	.50	.51	.48	0.7	0.45	0.42	0.23	0.27			0.5	
Width-to-depth Ratio	28.0	34.1	36.3	62.9	43.0	33.2	28.1	13.5	8.0	12.0			24.9	
Silt, Sand & Organic material (% area)	26	13	12	24	35	19	15	31	40	35	5	15	28	16
Gravel (% area)	46	39	24	34	35	31	28	29	30	27	20	37	60	45
Shade (reach average %)	62	76	88	95	96	89	89	93	81	90	89	87	93	97
LWD (pieces/100m)	3.5	5.5	6.1	7.7	6.9	13.3	5.0	18.4	14.2	16.1	4.3	14.1	12.4	5.2
LWD (volume/100m)	1.4	2.0	2.8	5.8	7.7	16.3	5.2	21.9	7.9	13.5	4.1	9.3	8.3	3.9
Riparian Conifers (#>20" DBH/1000')	0	0	68	0	0	30	46	0	0	0	0	122	61	0
Riparian Conifers (#>35" DBH/1000')	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Good Fair Poor

Stream reach map

Table III.6-9. **Summary of 1984 stream habitat survey of Slide Creek using criteria from the Aquatic Habitat Inventory Project Benchmarks (ODFW 1994a).**

Benchmark Criteria	REACH #				
	1	2	3	4	5
Pool Area (%)	56	54	36	40	35
Pool Frequency (channel widths)					
Residual Pool Depth (m)					
Width-to-depth Ratio					
Silt, Sand & Organic material (% area)	7	5	0	12	1
Gravel (% area)	19	24	4	35	18
Shade (reach average %)					
LWD (pieces/100m)	6	13	10	30	16
LWD (volume/100m)					
Riparian Conifers (#>20" DBH/1000')					
Riparian Conifers (#>35" DBH/1000')					

Good Fair Poor

* Aquatic habitat along the Middle Fork Coquille River in Secs. 29&30. T 29 S., R 10 W. was simplified as a result of splash damming. Large wood and boulders are deficient and probably greatly reduced from historic levels. BLM lands in this reach contain large conifer trees capable of recruitment into the stream channel, while private lands do not provide this potential.

* Because of the underlying geologic parent materials and soil types (see Section I-Characterization, and Section III.1-Erosion Processes), and low gradients on lower Sandy, Anderson and Belieu Creeks, these areas are prone to sedimentation. Sandy Creek is higher in suspended sediments than adjacent drainages, and is prone to siltation of aquatic habitats; Anderson and Belieu Creeks are prone to stream channel aggradation by course sediments.

* Within the analysis area, fall chinook salmon spawn in the lower six miles of Sandy Creek

and in several sections of the Middle Fork Coquille River. According to the 1980 Sandy Creek survey, anadromous fish distribution is limited only by natural high-gradient barriers. Sandy Creek tributaries that support coho and steelhead include tributaries A, B, E, F, G; steelhead also use tributaries E and F (Figure III.6-2). Cutthroat trout were found above the cascade and in nearly all tributaries. This species distribution information is based on incidental sightings made during spawning and habitat surveys, and may therefore be incomplete.

* Debris torrents originating from clearcuts in tributaries B and Z of Sandy Creek (Figure III.6-2); further described in Section III.1-Erosion Processes), resulted in areas of deep channel incisement, export of large amounts of sediment, removal of riparian vegetation, displacement of large wood out of the stream channel to high terraces (the torrents' energy dissipated before reaching mainstem Sandy Creek), and diminished aquatic and riparian habitat complexity. Effects to populations of coho salmon, steelhead, resident trout, and other aquatic invertebrates and amphibians are unknown.

The 1994 aquatic habitat inventory data for Sandy Creek ODFW 1994a), and the 1984 data for Slide Creek (Tables III.6-8 and III.6-9) indicates the following:

* There are adequate numbers of pools well dispersed throughout most of the fish-bearing reaches on the mainstems of Sandy Creek and Slide Creek. However, most of the pools within the lower seven miles of Sandy Creek are of inadequate depth for over-winter rearing. This shortcoming is largely due to the scarcity of large woody debris and boulders (which facilitate scour) and the preponderance of bedrock substrate (which does not scour). Most Sandy Creek tributaries, on the other hand, do not have adequate numbers of pools. Due to the relative abundance of gravel and large woody debris, however, pools that are present appear to be sufficiently deep to provide over-wintering habitat. Taken together, this data indicates that the streams in the Sandy Creek sub-basin have limited rearing potential.

* There is an overabundance of fine sediments (silt, sand, and organic material) in the mainstem and tributaries of Sandy Creek; this condition appears to be less severe in Slide Creek. This problem can result in poor egg-to-fry survival of salmonids, because fine sediments restrict the flow of water through the interstitial spaces in spawning gravel, thereby suffocating eggs. These interstitial spaces are primary habitat areas for larval amphibians.

* Most riffles in the Sandy Creek mainstem are in poor condition with regard to width-to-depth ratio (see Section III.3 - Stream Channel). This condition is more typical of unconstrained reaches of aggraded systems elsewhere. However, the mainstem of Sandy Creek has been incised (degraded) to bedrock in many areas and subsequently widened through bank erosion. Thus, in this case, the high width-to-depth ratio results from low summer flows over bedrock substrates. High width-to-depth ratio is problematic, because the concomitant increase in surface area renders the stream more susceptible to warming.

* The poor shade rating in the lowest reach of the Sandy Creek mainstem is responsible for the high water temperatures noted there during the summer of 1994 (see Section III.4 - Water Quality). Together, this information indicates that in the lowest reach of Sandy Creek, summer rearing habitat is temperature limited, due to removal of the riparian canopy. Slide Creek contains adequate canopy cover for most of its length.

* The Sandy Creek subwatershed and most of the Slide Creek drainage contain inadequate amounts of large wood; the condition in Slide Creek is less severe. Instances of heavy equipment operating in the channel to remove wood have been noted in Sandy Creek as recently as 1980. Large conifers (>20" dbh) are scarce in riparian areas, and there is little current recruitment of large wood to streams in these drainages, primarily due to the history of fire and logging, and the resultant young and maturing stands (see Section III.5 - Vegetation).

In March, 1996, as part of the Sandy Creek watershed restoration project (EA N0. OR128-95-06), an aquatic habitat enhancement project was carried out on a BLM parcel in T29S-R10W-Sec. 11 SW 1/4. Mature conifer trees (including rootwads) from the adjacent riparian stand were pulled over toward and into the channel to form “natural” accumulations (tree lining). Such trees are not currently being recruited from the adjacent maturing forest stand and surveys indicated the reach was devoid of large woody structure, spawning gravel, and winter rearing habitat for juvenile salmonids.

Silvicultural manipulations in riparian areas to improve potential for recruitment of large wood are discussed in Section III.5 - Vegetation.

SYNTHESIS & INTERPRETATION

<u>Role within the 5th Field Watershed</u>
The impact that the Sandy-Remote analysis area has on the larger 5th field watershed cannot be measured. It is assumed, however, that habitat conditions within the analysis area (except in lower Sandy Creek where splash damming occurred) are reflective of conditions elsewhere in the watershed.

<u>Influences and Relationships</u>
The harvest of conifers in riparian areas has subjected streams to potential temperature increases, and diminished long-term large wood input. Roads constructed directly adjacent to streams have compounded the problem by converting riparian areas to younger seral or disturbance habitats, and increasing sediment delivery to streams. Roads have also confined streams to narrower channels, thereby increasing velocities and simplifying the hydrological characteristics within the channels. Both natural and human-related fires and landslides have also changed riparian and stream channel characteristics dramatically. The riparian subsection of Section III.5-Vegetation addresses additional riparian vegetation and habitat conditions.

Aquatic and riparian habitat in the lower 5-6 miles of Sandy Creek has been greatly modified by the clearing of the floodplain for agricultural/pasture land, and the splash dams that operated in the 1920's. A detailed study of the effects of splash damming on stream channels is given in Wolniakowski et. al. (1990). In summary, overhanging bank vegetation was cut and boulders and large woody debris were removed to facilitate log transport. The result of this was a loss of habitat complexity, destabilization of banks, channel incisement and accelerated sediment transport.

In their historic condition, the stream channels in the Sandy-Remote watershed were vastly more complex than at present, owing to the structure provided by boulders and abundant large wood. This structural complexity functioned as a filtering mechanism. Thus, a large percentage of the annual nutrient and organic carbon inputs in the form of leaf/needle litter, fine woody material, and carcasses from anadromous fish were retained within system to be released over time by bacteria, fungi, and detritivors. This supply of nutrients and energy in turn fueled primary and secondary production, which contributed to a healthy and vigorous fish and wildlife community.

This process has been altered directly and indirectly by simplification of the stream channels in Sandy Creek and probably other tributaries within the watershed. With reduced channel complexity, the filtering mechanism is impaired, such that nutrients and organic carbon inputs are exported from the system more rapidly. This leads to reduced productivity in the system. Furthermore, the reduction in channel complexity translates into diminished habitat, which has impaired the system's capacity to successfully rear juvenile anadromous salmonids, and in turn has reduced the number of returning adults with their concomitant nutrient and organic carbon inputs (Bilby et. al. unpublished). Finally, changes in the riparian plant community have altered the quality and quantity of organic inputs from litter. Such a change has undoubtedly altered the watershed's microbial and invertebrate fauna, and thus affected both the mechanisms and rates of nutrient and organic carbon cycling in the watershed.

A second process that has been altered as a result of channel simplification is the flow of sediments. As with nutrients and reduced carbon, a structurally complex stream channel impedes the export of sediment by trapping it, dissipating stream energy, and creating depositional areas. While the net flow of sediments is necessarily downstream, the rate and periodicity of transport are variable, and are moderated by channel structural complexity. In a structurally complex channel, small quantities of sediment move relatively slowly downstream in most years, and this process is punctuated by infrequent, high-runoff events that rework the channel by moving large amounts of sediment and debris. While dynamic, sediment export is roughly comparable to sediment delivery over time, such that this system strikes a balance in which substrate composition is maintained throughout the system. However, in a simplified channel, displacement of significant quantities of sediment may occur very frequently, and the balance is lost. As a result of channel simplification from splash damming and removal of woody debris, many sections of Sandy Creek, and of the mainstem Middle Fork Coquille within the analysis area, are incised, dissociated from the floodplain, and dominated by bedrock. Bedrock channels that lack the potential for recruitment of large wood, cannot trap sediments or other structures necessary for deposition of gravels and creation of spawning and rearing habitats.

In-stream habitat structures often fail to achieve objectives or have a reduced life span as a result of project initiated stream channel adjustments. Knowledge of channel responses to artificially placed structures can be used to plan and design appropriate structures and protect project investments.

Log jams are important contributors to the biologic and hydrologic process of streams and rivers.

They are especially important in maintaining water tables for low flow releases, and for causing interactions of the stream or river with the floodplain.

Trends

Left alone, natural processes such as succession in the riparian community, will gradually improve the quality of aquatic and riparian habitat, restore other processes, such as nutrient and sediment flows, and facilitate the recovery of indigenous fish populations and other sensitive aquatic organisms in the watershed. However, this natural healing process is threatened because critical components are missing (i.e., potential for recruitment of large wood, accelerated sediment delivery, elevated peak flows), and impacts within and outside the watershed continue. Furthermore, in its present condition, the Sandy Creek watershed is ill-equipped to handle unpredictable events, such as flooding.

Headwater streams (both intermittent and perennial as defined in Section III.8-Riparian Reserve Evaluation) provide a functional link between upland terrestrial habitats and the downstream aquatic and riparian environment. They provide unique habitats for a host of aquatic macroinvertebrates, amphibians, and other riparian-associated wildlife. Species groups associated with these habitats, potential environmental hazards (e.g., harvest, windthrow, fire, debris flows or torrents), and the vulnerability of these species and their habitats to such hazards are discussed in Section III.8-Riparian Reserve Evaluation.

The aquatic habitat enhancement project (tree lining) conducted on Sandy Creek in 1996 should result in immediate (within 1 year) increases in habitat complexity from large woody structure. Trees placed in and across the stream channel, and on the riparian forest floor, should be effective in trapping and retaining sediment and smaller debris, and increasing the association of the active channel with its floodplain. Log "spanners" trap wood floating downstream during storm flows to help create small wood jams, and they provide foraging and stream crossing structures for birds, small mammals, and herptiles. Large wood on the forest floor and floodplains will provide substrates and cover for a host of fungi, invertebrates, and herptiles. The increased habitat diversity and greater similarity to natural conditions would benefit most native fish and wildlife species.

Reduction of water velocity, deposition of substrates, and scouring of pools in this reach is expected to occur within five years of large wood placement, or after the first large sediment-transporting storm. Deposition of gravel substrates for aquatic invertebrates and spawning fish, trapping and retention of large and small wood debris, and scouring of pools for fish would contribute toward increased fish production in this reach. Pre-project habitat inventories and fish population surveys have been conducted, and post-project surveys are continuing, to determine if the project improves aquatic habitat.

Trends in riparian vegetation and habitats, and silvicultural manipulations in riparian areas to improve potential for recruitment of large wood are discussed in Section III.5-Vegetation.

Management Objectives

A management objective for aquatic habitat would be to meet or exceed the ODFW (1994a) criteria for "good" habitat with respect to all parameters in all fish-bearing reaches, as verified by aquatic habitat surveys. An abundance of large wood in the stream provides excellent structure and complex aquatic habitat. Such conditions are required throughout the watershed to sustain the varied life histories of sensitive fish and wildlife species, to provide substrates for primary and secondary production, and to benefit water quality through numerous physical and biological processes.

Human-caused barriers and impediments to fish passage should be removed or modified to allow the native fish species access to their historic range.

AQUATIC and RIPARIAN SPECIES

<u>Analysis Questions:</u>

What aquatic and riparian associated species historically occupied drainages in the analysis area?

What aquatic and riparian associated species are currently present, and how are they distributed?

Are available spawning and rearing habitats fully utilized?

What is the role of this analysis area within the larger 5th field watershed with respect to species viability?

What are the <u>influences and relationships</u> of aquatic and riparian associated species with other ecosystem processes and elements (e.g., sedimentation, vegetation, habitat), and what natural and management-related processes have the potential to reduce or limit the viability of these organisms?

What are population <u>trends</u> of sensitive aquatic organisms in the analysis area?

What are the <u>management objectives</u> for aquatic and riparian species in the analysis area?

What <u>management actions</u> (restoration, maintenance, protection, etc.) could be undertaken that would be maintain and/or restore the desired populations of aquatic species? (See Section IV - Recommendations)

REFERENCE CONDITION

A fish species list and distribution map (Figure I-11) are located in Section I-Characterization.

Aquatic and riparian associated species are listed in Section III.8-Riparian Reserve Evaluation.

Additional information about riparian associated terrestrial species is located in Section III.6-Species and Habitats (subsections: Terrestrial Habitat, Terrestrial Species).

Fish

There is no historical data that quantifies fish population sizes; however, gill net and commercial fish landing records can be used as a reference against which to compare current population estimates. The Coquille River has a long history of gill netting (through 1949) and commercial fishing, which supplied salmon for several local canneries and for export. ODFW (1992) reported commercial landings of fall chinook salmon and winter steelhead from 1923 to 1949. For this period, the average commercial catch of chinook was 3,800 fish/year, with a peak of 27,000 in 1948. For steelhead, the average commercial catch was 4,000 fish/year, with a peak catch of nearly 10,000 in (ODFW 1992b). ODFW (1992) also estimated that the total annual run of wild coho salmon in the Coquille River "may have been as large as or larger than 70,000 fish per year" prior to the 1920's, based on gill net landing data.

CURRENT CONDITION

Fish

Pacific coast coho salmon and steelhead (including Coquille River stocks) have been proposed for listing under the Federal Endangered Species Act. A decision as to whether or not to list coho salmon as Threatened or Endangered is expected before the end of 1996. Nehlsen et. al. (1991) reported Coquille River stocks of coho salmon and sea-run cutthroat trout to be "at risk" of extinction as a result of habitat degradation, over fishing, and other factors. The National Marine Fisheries Service is presently conducting comprehensive status reviews on coho and chinook salmon, steelhead, and sea-run cutthroat trout, in preparation for making a determination as to their impending federal status.

There is limited spawning survey data available specific to the analysis area (Table III.6-10). ODFW conducted random spawning surveys for coho salmon on Sandy Creek in 1990, 1991 and 1992 (ODFW 1993a; data available from ODFW, Corvallis, OR). Spawning population estimates of chinook salmon, using the area-under-the curve method (AUC) (ODFW 1995), were calculated using data collected incidental to the random coho surveys. BLM surveyed chinook, coho and steelhead in standard BLM reaches in 1993, 1994, and 1995 (records and reports on file in the Myrtlewood Resource Area, Coos Bay District BLM).

It is difficult to assess trends in Sandy-Remote salmonid populations, or how they compare with other populations in the Coquille Basin. This is due to lack of spawning survey data in comparative reaches and through random surveys, high confidence intervals around spawning escapement population estimates for a given reach, and year to year variability in populations due to ocean and other environmental conditions. Given this caveat, the survey data was used to show how existing surveys measure against the ODFW's basin-wide targets.

Fall Chinook Salmon

The current population of fall chinook salmon in the Coquille basin is likely somewhere between 3,000 and 10,000 fish. This compares with a management goal of 9,000 fish for the entire Coquille River basin (ODFW 1992b). Based on BLM and ODFW surveys (Table III.6-10), spawning escapement in surveyed reaches was below the desired condition in 5 of the last 6 years; this suggests that spawning areas in the analysis area are not fully utilized.

Table III.6-10. Spawning surveys within the Sandy-Remote watershed, 1991-1995, and population estimates of salmonids (number fish per mile, adults and jacks).

Survey Type	Spawning Year Population Estimate (AUC[1])					
	1990	1991	1992	1993	1994	1995
Fall Chinook						
Sandy Cr. (ODFW random[2])	47	7	13			
Sandy Cr. (BLM standard)				1	9	1
Coho						
Middle Fork Coquille (all ODFW random surveys)	21	18	0	59	21	
Sandy Cr. (ODFW random)	15	5	0			
Sandy Cr. (BLM standard)			0	59	37	25
Slide Cr. (ODFW random)					15	
Belieu Cr. (ODFW random)		0				
Steelhead						
Sandy Cr. (BLM standard)					20	32
Sandy Cr. trib. (BLM standard)					41	

[1] AUC = area-under-the-curve; ODFW method used to calculate chinook and coho spawning populations assumes length of residence on redds = 11.3 days for coho, 10 days for chinook, 3.2 days for steelhead. Estimated spawning escapement for steelhead was based on redd count instead of fish. Spawning year 1990= winter 1990-91, etc.

2 chinook data was collected incidental to random coho surveys.

Spawning survey data for fall chinook salmon in the Middle Fork Coquille River extending back to 1961 indicates no clear population trend (ODFW 1995). Coast-wide, spawning escapements of chinook salmon in standard stream segments (peak count) has increased since 1950 (ODFW 1995). While a stable or increasing fall chinook salmon population may be implied, it should be noted that impacts to the population may have occurred in the era of splash damming and large scale commercial harvest, before the spawning survey data was collected.
Fall chinook salmon spawn in Sandy Creek between the first week in November and the end of December, with peak activity from the second week in November through the first week in December. No information on age-class distribution of any of the Sandy-Remote salmonid populations is presently available; however, age composition of fall chinook salmon within the Coquille River system indicates the spawning population primarily consists of age-3 and 4 males and age-5 and 6 females (ODFW 1992b).

Coho Salmon

Coho salmon spawn in tributaries between the first week in November and mid-January, with peak activity in late December. Standard spawning ground surveys of coho salmon conducted throughout the Coquille River system since 1958 shows a clear decline in spawning escapement over the past 35 years (ODFW 1995). In addition, the population of adult wild coho salmon within the Coquille River basin was below the minimum escapement goal of 16,380 fish (42 adult fish/mile) for 8 of 10 years from 1985-1995 (ODFW 1992b, ODFW 1995). This is also significantly lower than the estimation of nearly 70,000 fish in the early 1900s.

Based on BLM and ODFW surveys (Table III.6-10), coho salmon spawning escapement in Sandy Creek, as well as in the entire Middle Fork Coquille River, was below the desired condition (42 adult fish/mile) in 5 of the last 6 years. This suggests that spawning areas in the Sandy-Remote watershed are not fully utilized.

BLM conducted a summer juvenile fish survey (seeding level) on a 1.5 mile reach of Sandy Creek in 1994. This data indicates a seeding level of 1.46 coho/m^2 pool. However, because the 1994 water temperature data indicates that rearing habitat in the lower 3 miles of Sandy Creek may be temperature-limiting, and because habitat conditions and fish distribution vary among reaches, the high loading density noted in the 1994 survey should not be extrapolated to all fish-bearing reaches. ODFW electrofished pools in Sandy Creek throughout the mainstem during 1991, 1992 and 1993, two of which were in the BLM survey reach. Summer seeding levels of juvenile coho salmon from this data averaged 0.48, 0.61, and 0.17 coho/m^2, respectively (data obtained from ODFW, Charleston, OR). Together, the BLM and ODFW data indicates that summer seeding levels of juvenile coho salmon in Sandy Creek were below carrying capacity (1 coho/m^2 pool) for 3 of the last 4 years. Such an under-seeded condition might be attributable to low spawning escapement, low egg to parr survival, temperature limitations in the lower reaches, or a combination thereof.

Winter Steelhead

The current population size and carrying capacity of adult and juvenile winter steelhead in the Coquille River are unknown (ODFW 1992b), but they are likely below the spawning population escapement goal of 10,000 fish. Based on angler catch records, winter steelhead populations in the Coquille River were below their 20-year average during seven out of ten years from 1981-1990 (Nickelson et. al. 1992). This suggests a downward trend in the winter steelhead population of the Coquille River. With the exception of a few surveys conducted by the BLM, “the only knowledge of spawning habitat for winter steelhead is the observation of winter steelhead during coho salmon spawning ground surveys” (ODFW 1992b). Furthermore, there is insufficient information from BLM survey reaches (Table III.6-10) to estimate the steelhead population.

Steelhead spawn in Sandy Creek from mid-January through the first week in April. The spawning period for steelhead is quite protracted, but peaks may be observed once in February and once in March, depending on rainfall events. Because it is often difficult to observe steelhead in streams and on redds, the total redd count may be used to estimate the spawning escapement survey reaches.

Other Fish
No data is available from which to assess the population status of other fish species in the Sandy-Remote watershed. However, anecdotal information suggests that the numbers of spawning Pacific lamprey (BLM 1993) and resident and sea run cutthroat trout (ODFW 1992b) are below historic levels. Speckled dace populations are thought to be above historic levels, or at least more widely distributed, due to water temperature increases within the watershed.

Beaver
Beaver habitat includes most low-gradient, lower portions of tributaries to the Middle Fork Coquille River. Beaver dams or activities were noted during fish habitat surveys in Anderson Creek (1975), Slide Creek (1984), and Sandy Creek (1994). On Sandy Creek, nine dams were noted in tributary D (Figure III.6-2), and isolated activity was noted in reach 1 and around tributary A. Beaver can significantly alter riparian vegetation through their feeding and dam-building activities. Beavers also affect stream channel morphology by creating pool areas where sediments are deposited. Beaver ponds can provide optimal rearing habitat for juvenile coho salmon.

Other Aquatic and Riparian Associates
Aquatic and riparian associates are found in or adjacent to streams or seeps (refer to Table III.8-2, pg.143). Many are strongly associated with cold, clean running water, and clean substrates (i.e., no silt). Southern torrent salamanders and tailed frogs are usually found in water < 61E F (usually < 54E F) (Nussbaum et. al. 1983). Corn and Bury (1989) suggested that the absence of fine sediments was an important characteristic of Southern torrent salamander habitat. *Lanx alta* is associated with high water quality (Frest and Johannes 1993). Aquatic amphibians and invertebrates which use streams as travel corridors are also potentially impacted by culverts which act as barriers to movements. Dunn's and Southern torrent salamanders are widely distributed. Tailed frogs are known from one site although surveys have been limited. No surveys have been conducted for the aquatic snails but Sandy-Remote is potentially within the range of these species.

Two species of freshwater bivalves (mollusks), *Gonidea angulata* and *Margaritifera falcata*, are present within the mainstem Middle Fork Coquille River and in the lower reaches of Sandy Creek. These species are probably less abundant or less widely distributed than historically due to depletion of deep substrates in these areas.

SYNTHESIS & INTERPRETATION

Influences and Relationships:

Fish
In general, the key process affecting the size of spawning populations of anadromous fish in the analysis area (and within the larger 5th field watershed) is probably ocean survival. Mechanisms which impact ocean survival are variable ocean conditions and harvest rates. For a more detailed description of how ocean conditions (i.e., El Nino and harvest) affect survival, refer to the Sandy Creek Watershed Analysis (BLM 1995).

Processes of population dynamics have also been affected by management of Coquille River fish stocks. Genetic impacts to wild salmon and steelhead populations in the Coquille River, and in Sandy Creek, have resulted from interbreeding between wild fish and hatchery strays and introductions of genetic stocks from outside the Coquille River drainage (steelhead - Alsea, Coos, and Umpqua stocks; coho salmon -Columbia and Rogue stocks). Another byproduct of management efforts is the interaction between hatchery supplementation and regulation of the fishery. In concert, these two forces may act to reduce both the percentage and absolute numbers of wild fish in a population, according to the mixed stock hypothesis.

The conditions affecting egg to parr survival are aquatic habitat, water quality, and stream productivity. These conditions have been impacted by processes of poor riparian condition and function, and altered flows of sediment, organic carbon, and nutrients. The process affecting over-winter survival is loss of habitat complexity. The mechanisms affecting habitat complexity are associated with timber harvest and road construction and are addressed in the "Aquatic Habitat" section.

Spawning gravel is less abundant than historically (see subsection: Aquatic Habitat), but it is probably not limiting overall production of fall chinook salmon in the analysis area. Summer water temperature in mainstem reaches (e.g., mainstem Middle Fork Coquille River), and high water temperature and depleted oxygen levels in the upper estuary are probably the most significant factors limiting natural production of fall chinook salmon because of the limited rearing habitat available to juveniles (ODFW 1992b).

The primary limiting factors for overall coho salmon production include freshwater and ocean conditions, habitat quality (especially winter rearing), and coho harvest regulations.

The primary limiting factors for winter steelhead populations in the Coquille basin are hatchery stock influences on wild runs, and depletion of overwintering habitat (woody structure). Winter steelhead returns to the Coquille system are comprised largely of hatchery stocks (>75%) on all but the Middle Fork Coquille River.

<u>Beaver</u>

Beaver populations have been heavily impacted by trapping and other active control programs aimed at protecting human developments (roads, pastures, orchards, etc.) that are impacted by beaver dam building activities. Their populations are likely somewhat reduced from historic levels. While beaver population levels are not of particular concern, their impacts on stream hydrology and aquatic species are very beneficial. Opportunities may exist to receive beavers relocated from other problem sites into suitable habitat.

<u>Other Aquatic/Riparian species</u>

Most of these species are adversely affected by activities that increase water temperature or sedimentation. Road culverts with high downstream drops could also severely restrict upstream movements for these species. Habitats for these species have been severely impacted in the past by road building and timber harvest which have served to degrade habitat by increasing water temperature in some reaches, increasing sedimentation (particularly in low gradient reaches), and fragmenting reaches of suitable habitat. Corn and Bury (1989) found that uncut forests upstream from harvested areas provided important refugia for amphibian diversity.

Trends

Insufficient data exists to assess fish population trends, and the impact that Sandy-Remote salmon stocks have on the health of the larger 5th field watershed (i.e., the Coquille Basin) cannot be quantified. However, there is sufficient data to assess the population trends of some fish species at the larger scales of the Middle Fork Coquille River and Coquille River basin. It is assumed that population trends in the analysis area are a reflection of the overall condition of stocks within the North, East, and Middle Forks of the Coquille River combined (fish stocks in the South Fork Coquille River are somewhat different; see South Fork Coquille Watershed Analysis, BLM 1996). A comparison of current and historical conditions indicate that coho salmon and steelhead stocks have declined in recent years, while chinook salmon stocks appear to be somewhat stable. Protection of aquatic and riparian habitats on public lands, and restoration initiatives on both public and private lands, will likely assist in the recovery anadromous and resident salmonid stocks, if ocean conditions and fish harvest management are also favorable.

With Riparian Reserves and the Aquatic Conservation Strategy protective measures of the Northwest Forest Plan, habitat conditions for most of the aquatic and riparian associated species on federal land should improve as riparian and aquatic habitats recover with time. Private timber harvest and road building activities, with their limited protections afforded by the State Forest Practices Act, will likely continue to fragment and degrade riparian habitats.

Management Objectives

For the Coquille basin, the spawning population management goals are 9,000 chinook salmon, 16,380 coho salmon, and 10,000 wild steelhead (ODFW 1992b); the desired condition of the fish community in Sandy Creek is self-sustaining population of native anadromous and resident species. For coho salmon, this means minimum summer seeding (rearing) levels of approximately 1 coho parr/m^2 pool (Nickelsen et. al. 1992) and adult spawning escapement of 42 adult fish/mile (ODFW 1992b). For other anadromous species, this means consistent or increasing annual spawning escapement as determined by spawning surveys. For resident fishes (cutthroat trout, suckers, and sculpins), this means consistent or increasing population estimates obtained via seining/electrofishing (with the exception of speckled dace, which may decline as water quality improves).

III.7 CORE TOPIC - HUMAN USES

Analysis Questions:

What are the <u>*cultural resources*</u> *within the analysis area?*

What the <u>*tribal uses and treaty rights*</u> *within the analysis area?*

What are the <u>*dominant human uses*</u> *within the analysis area?*

What are the <u>*transportation management objectives*</u> *for BLM roads within the analysis area?*

CULTURAL RESOURCES

The Sandy-Remote analysis area has been the location of both prehistoric and historic cultural activities. As in historic times, the focus of prehistoric activities probably was the Middle Fork Coquille River, which bisects this area. The river provides an important transportation link between the southern Oregon coast and Camas Valley, both vital areas for prehistoric resource acquisition. As well as allowing access to gathering and hunting areas, the river and tributary streams also provided their own suite of fish and shellfish resources.

Archeological surveys of lands within the Coast Range have located relatively few prehistoric cultural resources. While several other criteria also are seen as important, the great majority of recorded prehistoric sites in the Coast Range have been found on relatively flat land forms (Toepel and Oetting 1992). According to their model, slopes greater than 20% hold little potential to contain recoverable prehistoric cultural resources. Applying this model, Figure III.7-1 illustrates that most relatively flat land forms with high (#10% slope) or moderate (11% to 20% slope) potential for prehistoric sites are the relatively small alluvial river and stream terraces. These terraces are located along the Middle Fork Coquille River and along some feeder stream channels, particularly along Sandy Creek. In contrast, most upland areas are deeply dissected with steep slopes. As expected in the Toepel and Oetting model, the majority of recorded prehistoric sites in this analysis area are located on flat alluvial terraces.

While the steep topography is typical of this part of the Coast Range, this area also contains some unusual topographic features, in the substantial areas of hummocky, marshy ground containing many small bogs. These are found along the northwest and northeast margins of the watershed, in Sec.6, T. 29 S.,R.9 W. and Sections 3, 8, and 9 T. 29 S.,R.10 W. These areas were examined, but did not locate any evidence of prehistoric use. However, the presence of this unusual topography suggests the possibility of differing prehistoric land use patterns in these areas from that of the adjacent deeply dissected land forms.

Many of the historic activities centered along major waterways. The Middle Fork Coquille River has been a travel route between the Coos Bay vicinity and Roseburg from the late 19th century, and today State Highway 42 is one of the major travel routes to and from the coast.

Prehistoric site map

As elsewhere in the Coast Range, logging opportunities first drew Euro-Americans to settle along the Middle Fork Coquille River, and many of the known historic resources on upland BLM lands are remnants of early lumbering and homesteading. Prior to the use of trucks, lumbering relied on river transport to deliver logs to the downstream mills. Two splash dams dating from this period are recorded along this portion of the river.

In 1924, the Middle Fork Boom Company built three splash dams on the Middle Fork Coquille River; one at Slater Creek, another 3/4 mile downstream from Remote, and a third at Sugarloaf. (Beckham 1990). Two splash dams were also constructed on Sandy Creek during the 1920's (Wolniakowski et al. 1990 & Farnell 1979). The splash dams on Sandy Creek were abandoned after less than a decade. However, the splash dams on the Middle Fork Coquille River operated through 1939, due in part to the persistent channel "maintenance" activities of the Port of Coquille (Beckham 1990).

Recorded Native American Cultural Resources

Two village sites have been recorded on alluvial terraces at stream confluences with the Middle Fork Coquille River. As well, one upland hunting camp has been found in a meadow overlooking one of the major tributary streams, not far upstream from the river. An isolated artifact, probably associated with hunting activity, also has been recorded along an upland stream channel. Undoubtedly, these known prehistoric sites represent only a fraction of the localities used by Native Americans during their residence of several millennia. Fishing, hunting and gathering all would have been important resource acquisition activities conducted.

Recorded Euro-American Cultural Resources

Known early historic cultural activities are represented by homesteads and remains from lumbering. Two cabins (one belonging to John Belieu) and a sawmill are reported from the vicinity of Belieu Creek. A logging camp is located along Sandy Creek, and two steam donkeys and an associated temporary camp recently were found on BLM land in the Sandy Creek drainage. (additional detail on development of this area can be found in the Sandy Creek Watershed Analysis (BLM 1994)

NATIVE AMERICAN TRIBAL USES AND TREATY RIGHTS

As elsewhere in southwestern Oregon, modern Native American concerns in the analysis area center around three general issues; land transfer, resource acquisition and heritage protection.

Land Transfer

In United States Court of Claims testimony (Federal Supplement 1945:945), anthropologist John P. Harrington described the boundaries of the traditional territory of the Coquille Indian Tribe as extending throughout the entire Coquille River watershed (Hall 1995:26). A small part of the land currently identified (as of August 5, 1996) by the United States Senate (Senate Bill 1662) to be included within the proposed “Coquille Forest”is within this analysis area (BLM land in Section 26, T. 29 S.,R.11 W).

Resource Acquisition

The existence and extent of Native American rights to “usual and accustomed” places for modern resource acquisition (hunting, fishing and gathering) on public lands is an issue which continues to be addressed in ongoing court cases. The location and modern utilization of specific resources is not known at this time. However, the District does plan to engage in periodic consultation with the Coquille Indian Tribe concerning the activity plans of both organizations. Concerns about planned activities affecting resource utilization locations should become evident as a result of such contacts.

Heritage Protection

Federal legislation aimed at protection and preservation of significant archeological sites addresses one facet of tribal interests in cultural heritage protection. However, the identification of land important as a “traditional cultural property” (or a “sacred site”) may not be based on physical evidence of past use, and therefore could involve properties in this analysis area which otherwise are not known to have cultural importance. As of this time, the Coquille Indian Tribe has not informed the BLM that such resources occur on public lands. Ongoing consultations with the tribe in connection with specific activity plans also should clarify any concerns about such localities.

DOMINANT HUMAN USES

Timber Production

A majority of the analysis area is managed for timber production. With 30% reserved from harvest (primarily BLM lands only) and perhaps <3% in residential, agriculture, or grazing, the remaining 65±% is available for timber management. Intensive forestry management often includes short rotation ages (40 to 60 years), site preparation after harvest (burning or mechanical), planting to desired species, removal of undesirable species, and thinning (precommercial and commercial) to obtain optimal spacing for volume production. Herbicides are commonly used on private lands for site preparation and to control undesirable tree and brush species.

The level of harvest activity can be expected to increase on private lands as their second generation forests reach rotation age. Activity on BLM lands can be expected to be stable over the next few decades, but at a reduced level than the 1970's and 1980's. due to the management direction in the RMP.

Special Forest Products

One of the most common special forest products harvested in the analysis area was cedar boughs, especially Port-Orford cedar. Understory Port-Orford cedar trees adjacent to roads or on easily negotiable terrain have been heavily pruned by bough pickers. This results in trees with approximately a 25% live crown and three to four inch stubs along the tree bole. Harvest of Port-Orford cedar boughs has been prohibited on BLM lands for the past 2 - 3 years, however, some illegal picking still occurs.

The amount of other products such as brush, mushrooms, or berries currently being harvested cannot readily be determined. Historically, except for Port-Orford cedar bough harvest, effects of removing these products have not been obvious. It could be anticipated that harvest levels might be somewhat higher than elsewhere due to its proximity to Highway 42, but how much in unknown.

Domestic Water Sources
Research located 15 residences along Sandy Creek which use either surface water or wells as their source for drinking water. The locations of these sites are generally on tributary streams of Sandy Creek (Figure III.2-4). There are several residences along Highway 42 in analysis area and these residences probably also have their water sources on the small frontal streams which are tributary to the Middle Fork Coquille River.

Transportation
State Highway 42 is a dominant feature. This east-west route is the major link between the southern Oregon coastal cites and US Highway 101 to the southern Interstate 5 corridor. Sandy Creek County Road is located adjacent to Sandy Creek and is the main road into this portion of the analysis area (Figure III.7-2).

The road system is a complex matrix of various road users and owners, state, county, BLM, private timber companies and individuals. Portions of Highway 42 and Sandy Creek County Road are located on BLM lands, as well as private timber company roads. The BLM has constructed roads on private lands through a variety of access agreements and private timber companies have constructed roads on BLM lands under 'reciprocal' right-of-way agreements. These agreements grant access rights to the BLM and the other party to cross each others land. These rights must be incorporated into any decision concerning road management.

The transportation system in the Sandy-Remote analysis area is comprised of approximately 130 miles of road. The BLM controls 57.8 miles of road within the watershed constituting 44% of the total. These BLM roads are used to access approximately half the land within the watershed. At least 76 miles (59%) are surfaced either with crushed rock or a bituminous oil (asphalt) treatment. The remaining miles are natural surfaced or are on private lands and the status is unknown. These figures, shown in Table D-1,Appendix D, have been derived from GIS, and while not complete (some data is missing, primarily on private lands), it does give the most precise and up-to-date information available.

As described in detail in Section III.6 Species & Habitat - Aquatic, several splash dams were constructed prior to 1940 for the purpose of transporting logs downstream

Rock Quarries
There are two large rock quarries within the analysis area. The largest, operated by Kinchloe & Sons Inc., is located adjacent to the Middle Fork Coquille in the SW¼ Sec. 36, T. 29 S., R. 11 W. The other is operated by Georgia Pacific West Corp. in the very northwest corner of the analysis area (NW¼ SW¼ Sec. 26, T. 28 S., R. 10 W.).

The Kinchloe quarry is unique to this part of the southern Oregon Coast. The source for the rock is a well-silicified marine basalt. This type of rock is known for it's high durability and low clay content. Many miles of forest roads and State highways throughout the Coquille area have been surfaced with crushed aggregate from this quarry. The rock source for the other quarry is massive sandstone member of the Tyee formation, commonly found throughout the Coquille basin.

Transportation MAp

Recreation
Recreation could best be described as dispersed as there are no official recreation sites. However, the covered bridge at the mouth of Sandy Creek serves as both a Historic Marker and a rest stop for Highway 42. The more common types of dispersed recreation throughout the area include, hunting, fishing, sightseeing, mountain biking, and harvesting of special forest products.

A mountain bile trail has been constructed on private timber company land in the upper reaches of Tanner and Belieu Creeks (Sec. 18, T. 29 S., R. 10 W.). This trail predominately utilizes existing dirt roads and is used by local mountain bike enthusiasts.

Public recreational opportunities along the Middle Fork Coquille River and Sandy Creek appear to be limited due to private land ownership.

Illegal Activities
Illegal activities consist mainly of theft of minor amounts of firewood, harvest of brush or tree boughs without authorization, and dumping of household garbage. The most popular dump site is Frenchie Creek Road, but small amounts can be found on forest roads throughout the area.

TRANSPORTATION MANAGEMENT OBJECTIVES

The BLM road system was evaluated for its present and future uses using a Transportation Management Objective (TMO) process. The TMO process applies only to roads controlled by the BLM, as management of those roads lies within the Bureau's jurisdiction. Roads evaluated as part of the Sandy Creek Watershed Analysis were re-evaluated to determine if the initial road management recommendations were still valid. Recommendations for Bureau roads can be found in Appendix D and background TMO information is on file in the Coos Bay District office.

III.8 RIPARIAN RESERVE EVALUATION

Analysis Question:

Are there suitable areas where modification to the interim riparian reserves on intermittent streams could occur?

If so, what are the suitable parameters necessary to meet the Aquatic Conservation Strategy?

What effect would possible reductions in the width of Riparian Reserves have on terrestrial wildlife species?

INTRODUCTION

The Riparian Reserves are areas along all streams, wetlands, ponds, lakes and unstable areas where riparian-dependent resources receive primary emphasis. The main purpose of these Reserves is to protect the health of the aquatic system and its dependent species, while also providing benefits to upland species. General guidelines for interim Riparian Reserve widths are described in the Aquatic Conservation Strategy of the Standards and Guidelines - ROD, 1994. Essentially, the width of the interim Riparian Reserves is a function of site potential tree height, potentially unstable lands, fish presence, flow characteristics, riparian vegetation, and the inner gorge.

PROCESS

Recommended procedures for Riparian Reserve evaluation are described in the Draft Riparian Reserve Module (REO 1996). This delineation module was attached to BLM Information Bulletin No. OR.-96-162. This guidance is meant to supplement "Ecosystem Analysis at a Watershed Scale: The Federal Guide for Watershed Analysis (version 2.2)". This module was used as a basic outline for the following evaluation. The steps essentially follow the Watershed Scale Procedures in the module.

The primary focus of this analysis is to assess the Riparian Reserve widths along intermittent streams necessary to meet the ACS objectives. The Riparian Reserve boundaries surrounding perennial streams are expected to approximate those already prescribed in the Standards and Guidelines of the FEIS ROD (pg B-13). Actual delineation of Riparian Reserves and posting of boundaries will occur at the project level during the NEPA process using the information provided herein along with additional information from field reviews.

Step 1

The variables used in determining interim riparian widths have been mapped or described to the extent possible with the data available.

The site potential tree height for the Sandy-Remote analysis area has been defined as 220'. Maps of geology, soils, and unstable lands (TPCC withdrawals) are shown in Figures I-5, I-6, and III.1-4 respectively. In addition, analysis was preformed on the landscape to evaluate surface erosion (using the Modified Soil Loss Equation) and mass wasting processes (using the Infinite Slope Equation). A detailed description of the methods and assumptions used in these analyses are presented in Appendix E. Figure III.8-1 shows the results of the surface erosion modeling in units of tons of sediment/acre/year. Figure III.8-2 shows the results of the mass wasting modeling, which derives a factor of safety (factors of safety approaching 1 indicate highly unstable areas).

Figure I-11 shows the stream network detailing the hydrographic pattern and distribution of fish-bearing streams.

Determination of intermittent streams will be made in the field based on the following definition and supporting criteria:

> Intermittent streams are defined as any nonpermanent drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria (FEIS ROD, p. B-14).

The Myrtlewood Resource Area Hydrologist provided the following interpretations to the Northwest Forest Plan definition of intermittent streams:

< To be a nonpermanent drainage feature, the stream should have a stream flow duration of less than 80% of the time.

< A definable channel should have some minimum depth of incision, or within a stream adjacent inner gorge. The channel should be able to convey stream flow, and be essentially continuous. A definable channel can exist even though large organic debris may at times be lying in the channel or partly hiding the channel.

< Annual scour or deposition is evident by distinct physical features, which may include: a stream scour line on the edges of the active channel, sediment accumulations behind obstructions in the channel, substrates in the channel are more rounded than angular, and evidence of bankcutting on the outside of bends.

Intermittent stream origin on District lands has been studied in two different geologies by using the intermittent stream ROD definition and interpretive criteria. Intermittent streams were found to form drainage areas between 4-13 acres with a tendency of about 7 acres (Carpenter 1995). The GRID program of ARC/INFO may be used to display flow accumulation data. By selecting certain flow accumulation values approximating the drainage area requirement, it is possible to map the intermittent channel origin.

An initial stratification process was used in the Sandy-Remote study area to identify intermittent streams. By using Darcy's law of groundwater flow, mapped soil types, and flow recession to estimate the reduction in saturated area of small catchments during the dry season, it was found that a watershed of approximately 20-40 acres is necessary on high permeability soil types to sustain perennial flow; streams in smaller catchments are likely to be intermittent (Dunne, T., and L.B. Leopold. 1978, and Haagen, J.T. 1989). This approximates the first order channel. Figure III.8-3 shows where potentially intermittent streams are located, based on this stratification process. There are approximately 43.1 miles of these streams.

Figure III.8-1

Figure III.8-2

Figure III.8-3

Intermittent streams tend to be first order, high gradient (>10%), low sinuosity, entrenched channels, with low width/depth ratios and gravel or sand substrates. This description fits A4a, and A5a stream types (Rosgen 1994). Other first order streams may be perennial. This is because deep fine textured soils surround these channels, store large volumes of water, have low permeabilities and drain slowly. This would correspond to A6a and A6 stream types. Some of these channels are lower gradient (4-10%) and may be draining perched water tables.

Perennial streams are "a stream that typically has running water on a year round basis" (FEMAT 1993). Alternate definitions include "a perennial stream or stream reach has measurable surface discharge more than 80 percent of the time. Discharge is at times partly to totally the result of spring flow or ground-water seepage because the streambed is lower than surrounding ground-water levels" (Meinzer 1923).

Biological criteria including the presence of aquatic invertebrates with protracted larval histories (> 1 year), or larval amphibians (tailed frogs, Southern torrent salamanders, Pacific giant salamanders), may indicate perennial flow. Conversely, the presence of certain species of aquatic invertebrates strongly indicates intermittent flow only. Lists of reference species are being developed by Myrtlewood fisheries biologists.

The extent of riparian vegetation may be used to delineate Riparian Reserves in some cases. However, the water dependant vegetation width is very narrow in most cases for intermittent streams. It is highly unlikely that riparian vegetation would extend the Riparian Reserve beyond one-quarter to one-half site potential tree height in the Sandy-Remote analysis area.

The inner gorge may also be used to delineate Riparian Reserve boundaries in some places. For the purposes of this exercise, an inner gorge is defined as the first slope break above the active channel margin and terraces. Typically, an inner gorge break would only be used to define a Riparian Reserve boundary of a canyon or similar feature.

It was determined that site-potential tree height defined the widest interim Riparian Reserve boundaries, when compared to the other direct or relative measurements. Based on a site-potential tree height of 220', the GIS database indicates that interim Riparian Reserves occupy approximately 5,153 acres (50%) of BLM-managed land. The output from the initial stratification process to identify intermittent channels (Figure III.8-3) indicates that approximately 2299 acres of Riparian Reserve (22% of BLM managed land) are adjacent to intermittent streams. It should be noted that this riparian acreage is an estimate; sources of error include unmapped streams and the difference between the actual location of the Riparian Reserve boundary (based on slope distance) and the computer-generated boundary (based on horizontal distance).

<u>Step 2</u>

Coos Bay District GIS library data was used to generate the following figures, which provided basic information on distribution of resources within the analysis area:

Figure I-4:	Land Use Allocations.
Figure I-10:	Timber Age Class Distribution on BLM-Administered lands.
Figure III.6-1:	Special habitats map.
Figures III.8-4,5,&6:	Riparian Reserve areas 40+, 80+, and 160+ years old.

Figures III.8-4

Figures III.8-5

Figures III.8-6

The majority of Riparian Reserve acres are associated with small (<3rd order) streams, while open water habitats (ponds and large streams) are restricted to a few small ponds on private land, the Middle Fork Coquille River, and the lower ends of Sandy and Slide Creeks. True riparian habitats with riparian-associated vegetation are generally restricted to narrow bands along 3rd order and larger streams. Forests on BLM-administered land in Riparian Reserves are highly biased towards 0-20 and 81-160 year old forests and biased away from 41-80 and 161+ year age classes (see Figure III.8-7). The oldest stands in Riparian Reserves are concentrated in the northern and central portion of the analysis area. The function of Riparian Reserves for the ACS and for other wildlife benefits assumed in the Northwest Forest Plan is tied to late successional forest habitat. Habitat for early successional species is generally of less concern (because of its abundance and because of the ecological characteristics of species associated with early successional habitats) and is generally provided in the GFMA.

Figure III.8-7 Forest Age Class Distribution of Riparian Reserves

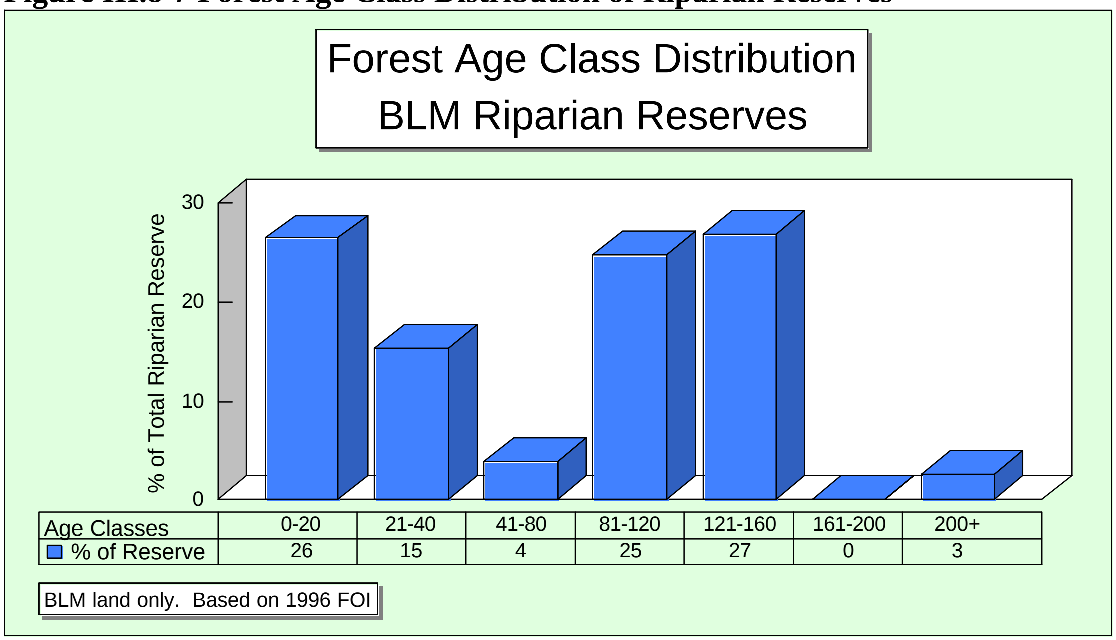
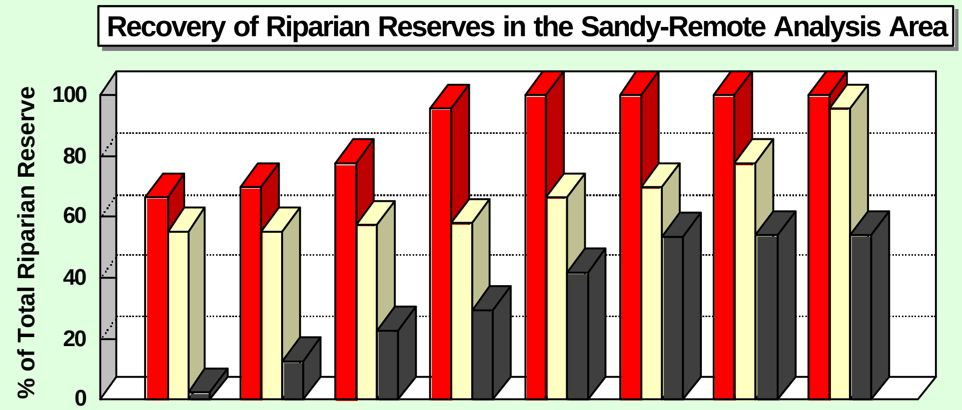


Figure III.8-8 shows the portion of Riparian Reserves that are 40+, 80+, and 160+ years of age, and projects the development of these areas through time. It also shows that it will be nearly 40 years before significant additional areas enter the 80-year age class and before >50% of Riparian Reserves contain trees older than 160 years.

Figure III.8-8 Projected Development of Riparian Reserves



Decade	2000	2010	2020	2030	2040	2050	2060	2070
Stands =>40 years	66.47	69.95	77.60	95.55	100.00	100.00	100.00	100.00
Stands =>80 years	55.28	55.28	57.56	58.16	66.47	69.95	77.60	95.55
Stands =>160 years	2.66	12.54	22.79	29.56	41.77	53.37	54.31	54.31

Assumption: Interim riparian reserve widths are maintained.

While spring and seep habitat is fairly common, it is difficult to map with available GIS data, however, they often occur at contacts between geological formations. Figure I-5 shows contacts between geological formations where springs and seeps may be present. Springs and seeps also occur on low permeability soil types in the analysis area including mapping units 4D, 4E, 10B, 17B, 33, 47B, 63B, 63C, 53D, and 53E, as seen in Figure I-6. Spring and seep habitat is important for many species of wildlife and, since they are not always along streams, they may sometimes be inadvertently missed when delineating Riparian Reserves in the field.

Rock (and to a lesser extent talus) habitats are also common and are generally associated with the formation in the north and east part of the analysis area, Frenchie Creek, and the west face of the ridge west of Slide Creek. Many of these currently fall within interim Riparian Reserves.

<u>Step 3</u>

The information presented in the figures above indicates that the quality and function of some of the riparian habitat have been degraded (e.g. with respect to LWD recruitment). Given time and sufficient protection, the natural process of succession and maturation will restore most of the degraded areas. However, where insufficient conifer seed sources exist, or alder-salmonberry stands inhibit establishment of conifers, active management may be required to restore Riparian Reserves to desired condition and function.

Stream habitat inventory data from ODFW (1994) was analyzed in Section III.6- subsection Aquatic &Riparian Habitat. Water temperature data from BLM (1994) indicates that the most serious water temperature problem in the analysis area occurs within the lower three miles of Sandy Creek. The remainder of the Sandy Creek drainage appears to have reasonably cool water temperatures.

Figures III.8-1 and III.8-2 are intended to be used by the interdisciplinary team during the EA process to indicate areas of relatively high and low stability, where modification of the interim

Riparian Reserve boundary may be more or less appropriate. It should be noted that the maps are model outputs and require field verification. The maps are perhaps most useful for prioritizing areas for field review, and graphically illustrating similarities and differences in stability across the landscape. Analysis of unstable areas, including a landslide inventory, is available in Section III.1-Erosion Processes.

Table 1. Risk assessment.

RESOURCE VALUE	ZONE OF EFFECT	HAZARD	VULNERABILITY / SUSCEPTIBILITY	LIKELIHOOD OF EXPOSURE	ASSOCIATED SPECIES GROUPS
Streambank/Slope Stability	1 & 2	Windthrow Landslide/Debris Flow Harvest Peak-/Baseflow Changes Fire	High[1] High[2] High[3] Moderate Low	Moderate Moderate Moderate[4] High[5] Low	Stream Seep Riparian
Microclimate	2 - 5	Harvest Windthrow Landslide/Debris Flow Fire	High Moderate Moderate High	High Moderate Moderate Low	Seep Riparian Late-Successional Bats
Sediment Regime	1 - 4	Landslide/Debris Flow	High	Moderate	Stream
LWD Recruitment	1 - 4	Harvest Windthrow Landslide/Debris Flow Fire	High High[1] High[2] Moderate	Moderate Moderate Moderate Low	Stream Riparian Late-Successional
Water Temperature	1 - 3	Peak-/Baseflow Changes Harvest Windthrow Fire	Moderate High Low High	High[5] Moderate Moderate Low	Stream Seep
Water Quantity	All	Peak-/Baseflow Changes	High	High[5]	Stream Seep
Late-Successional Forest Characteristics	2 - 4	Harvest Fire Windthrow	High High Low	Moderate Low Moderate	Late-Successional Bats

[1] On steep slopes with shallow soils and areas with high 'edge' contrast.
[2] Especially in areas immediately downstream from unstable headwalls.
[3] Highest vulnerability correlates with diminished root strength 3-7 years post-harvest.
[4] Harvest in BLM-administered riparian areas is unlikely, but State Forest Practice Rules do not protect all b riparian areas.
[5] Localized areas of increased peak-flow are likely given harvest on public and private lands.

Zone 1 - Aquatic (includes streams and seeps
Zone 2 - Stream bank (includes splash zone)
Zone 3 - Zone of riparian influence (includes area inhabited by riparian vegetation)
Zone 4 - ½ site potential tree height (approximately 100')
Zone 5 - One site potential tree height

Step 4

The methods described in Draft Riparian Reserve Delineation Module (IB-OR-96-162) were used to assess the function of Riparian Reserves for plants, fish, and wildlife. The impacts and risks of modifying the interim boundaries were to be assessed for those species.

Plants

Plant species analyzed in this assessment are listed in Appendix (botanical). These species are those listed in the Draft Riparian Reserve Delineation Module, as well as local species of concern and Survey and Manage species from the RMP.

The assessment process compared the likelihood for the species (or species groups) under Option 9 (Current Riparian Reserve widths of 220 feet) and Option 7 (which included only limited riparian reserves). These likelihoods were divided into four outcomes: 1) Habitat is of sufficient quality, distribution, and abundance to allow for species populations to stabilize, and be well distributed across federal lands; 2) Habitat is of sufficient quality, distribution, and abundance to allow the species population to stabilize, but with significant gaps in the historic range of the species distribution on federal land; 3) Habitat only allows continued species existence in refugia, with strong limitations on interactions among local populations; and 4) Habitat conditions result in species extirpation from federal land (FEMAT 1993 page IV-43).

Overall the impacts to the above listed species should be relatively minor by reducing some riparian reserve boundaries along intermittent streams in the Sandy/Remote Watershed Analysis Unit. Reducing Riparian Reserve widths does increase the risk of impacting these species, especially since no currently known sites for any of these species are documented within the watershed. Appendix E-2 details the assessment for each species (or species groups).

The only possible concern might be the Forage and Pin Lichens. There are no known documented sites, but there is potential habitat within the analysis area. Species which occur in the upper portions of the interim riparian reserves are most likely to be impacted from changing land use allocations from riparian reserve to matrix lands.

Fish & Wildlife
From a list of fish and wildlife species expected to benefit from Riparian Reserves, the following were filtered out using the methods described in the module:

Table III.8-2 Fish & Wildlife Species of Concern within Riparian Reserves

SPECIES	
*Cutthroat trout - both resident and sea-run	
*Fall chinook salmon	
*Coho salmon	
*Winter steelhead	
*Dunn's salamander ----------	upland salamander strongly associated with streambank habitats,
*Southern torrent salamander-	aquatic salamander dependent on cold, clear, streams and seeps
*Tailed frog -------------------	aquatic frog dependent on cold, clear, fast streams
*Yuma myotis ----------------	bat species which feeds over large streams, ponds, and lakes and is closely associated with water (Maser et al. 1981)
**Helisoma newberri newberri* -------	a freshwater snail associated with well oxygenated streams and stable gravel-boulder substrates (Frest and Johannes 1993).
**Lanx alta* ---------------------	a freshwater snail associated with large streams with stable cobble-boulder substrates and high water quality (Frest and Johannes 1993).
**Monadenia fidelis flava* ----	a land snail associated with riparian areas, generally in deciduous trees and brush (Frest and Johannes 1993).
**Vespericola sierranus*-------	a land snail associated with riparian areas, springs and seeps (Frest and Johannes 1993).
*covered by ACS objectives	
Three other species/groups were added because of local concern:	
Northern spotted owl---------	an old-growth forest associate for whom Riparian Reserves were expected to contribute significantly towards habitat suitable for dispersal of young owls and for movements of owls between LSRs.
American marten -------------	a wide-ranging mustelid often associated with late-successional forests in riparian areas.
Forest bats --------------------	forest bats use habitat features often found in Riparian Reserves for roosting (large trees with deeply fissured or loose bark, tree/snag cavities, rock crevices, bridges) and for feeding (in areas near water).

Further analysis was conducted on all species except Yuma myotis. The Yuma myotis was dropped from further analysis because it is associated with larger bodies of water and only Riparian Reserves along intermittent streams are being considered for modification.

For analysis, the species were grouped by habitat associations.

		Zone of Association				
Stream associates:		1	2	3	4	5
Cutthroat trout		X				
Fall chinook salmon		X				
Coho salmon		X				
Winter steelhead		X				
Southern torrent salamander		X	X	x		
Tailed frog		X	X	x		
Helisoma newberri newberri		X				
Lanx alta		X				
Seep associates:						
Southern torrent salamander		X	X	x		
Vespericola sierranus	X	X	X			
Riparian associates:						
Dunn's salamander			X	x		
Monadenia fidelis flava				X		
Vespericola sierranus	X	X	X			
Late-successional forest associates:						
Northern spotted owl					X	X
American marten				X	X	X
General bat forest habitat				X	X	X

X = primary association
x = secondary association (e.g. dispersal)

Additional Discussion

Late-Successional Forest Associates:

Approximately 62% of BLM-administered land contains habitat suitable for spotted owl dispersal, 46% of which occurs in interim riparian reserves (some of which are in LSRs). Approximately 46% of the entire analysis area (BLM and private) is expected to be in dispersal habitat condition in 10 years. See Section III.6-Species & Habitats for more discussion of spotted owl dispersal habitat.

General Bat Forest Habitat:

Key bat habitat features for bats include bridges, trees with deeply fissured or loose bark, tree cavities, and rocky crevices for roosting and water for foraging/drinking. These features are frequently found in Riparian Reserves and are not associated with a given distance from the stream (except water of course). Approximately 13% of Riparian Reserves presently have late successional forests >160 yrs of age (23% by the end of this decade). Many of the rock habitats are within interim Riparian Reserves.

Provincial and Watershed Context:

Stream, seep, and riparian associated species and American marten could use Riparian Reserves as dispersal corridors to and from adjacent subwatersheds. Four key areas of connection exist where several Riparian Reserves in the analysis area connect or nearly connect with Riparian Reserves in adjacent subwatersheds (Figure III.8-9).

Figure III.8-9

Probable Species Occurrence:

Survey data for all species except spotted owls are limited. Few surveys for the mollusk species have even been conducted state wide. Limited amphibian surveys have been conducted. The stream and seep associates, since they are associated with cold, clear water, are more likely to occur in Riparian Reserves containing late successional forests. The late-successional forest associates are also more likely to occur in Riparian Reserves dominated by late-successional forests. The riparian associates could occur in Riparian Reserves throughout the analysis area. General bat forest habitat could occur in Riparian Reserves containing late-successional habitats and in rocky areas. As forests in Riparian Reserves mature, available habitat for many of these species will increase.

AREAS OF POTENTIAL OPPORTUNITY FOR MODIFICATION OF INTERIM RIPARIAN RESERVES

Based on the proceeding analysis and the professional judgement of wildlife, fisheries, botany, hydrology, and soils specialists, there are opportunities to modify the interim Riparian Reserve boundaries on some intermittent streams in accordance with the Aquatic Conservation Strategy. The team recognizes that the analysis area encompasses diverse geomorphic features and habitats, and that the distributions of the species in Table III.8-2(above) within this area are not mapped or completely understood. Therefore, any modifications of interim Riparian Reserve boundaries must be analyzed at the site level and tailored to the specific features of the site. To this end, the following recommendations are intended to guide the interdisciplinary team in subsequent site-level analysis and planning:

Sensitive areas (higher risk of adverse effects)

1. Four areas of connectivity to adjacent watersheds (Figure III.8-9)

2. Seeps/springs - make sure they are included within Riparian Reserves and that the buffers are sufficient to maintain the characteristics of the site (eg. shading, cool water, sediments, stable substrates, similar flow patterns/timing, maintenance of riparian vegetation, etc.).

3. Rocky habitats - make sure they are not excluded from Riparian Reserves and that the buffers are sufficient to maintain the characteristics of the site (e.g. shading). Interim Riparian Reserve widths should not be reduced where such reductions would isolate TPCC withdrawal areas.

4. Total reduction of BLM spotted owl dispersal habitat should amount to < 1% (65 acres).

5. Only approximately 13% of Riparian Reserves are presently >160 yrs of age; therefore, old growth forest characteristics are rare in Riparian Reserves. Modifications of interim reserve widths should not reduce the amount of late seral or old growth riparian habitat from the 160+ age class.

6. Areas on sensitive soils including FGR2 (Figure I-6), and areas subject to mass wasting or shallow rapid debris flows (Figure III.8-2).

7. Riparian Reserve boundary closer to intermittent channels than 25-50 feet, depending on hillslope angle, would not afford sufficient water quality protection.

There is less risk in reducing Riparian Reserve boundaries if other reserve areas are added so that the total acres of reserves in the analysis area remain nearly constant. Opportunities to increase connectivity by joining nearby Riparian Reserves across ridges exist in Frenchie and Slide Creeks and may exist elsewhere.

Research indicates that the vast majority (85-90%) of LWD in streams is recruited from within 100 feet (30 meters) of the streambank (McDade et. al. 1990). Furthermore, "...harvesting within 30 meters of the channel will result in decreased delivery of woody debris from conifer trees" (Ursitti 1991). Therefore, to maintain LWD dynamics, Riparian Reserves should be at least 100' wide on each side of intermittent streams; except under the following conditions: 1)where a ridgeline exists within 100' of a stream (in which case the ridgeline may be used to delineate the Riparian Reserve boundary), and 2) on intermittent streams with discontinuous surface flow (where surface conveyance is restricted due to subterranean flow).

Slide Creek Drainage- Reserve widths of about 50 ft. each side of the stream or to the top to the inner gorge break should suffice to keep sediment out of the stream network and keep the channels intact. Reserves on the southwest side of the drainage on the Flournoy (Tmss) formation should be larger (60-75 ft) due to the steeper slopes. On the western side of the main Slide Creek drainage there are transient wet areas; these may be intermittent streams or seeps. These wet areas will be hard to find and require on-the-ground analysis during project design. The dry, stable areas on ridges will need to be identified and where any new roads or landings should be located. Reserve widths in this area should be in the 50 - 60 ft. range either side of the stream for regeneration-type harvesting. Activities within the Reserve could be allowed, but need to be designed for low-level ground disturbance for either commercial thinning or final removal activity.

Middle Fork Frontal Drainages- Slopes on the south side of Hwy. 42 are prone to landslides and reserves should be 150 to 200 feet from each side of the stream. Activities such as commercial harvest and thinning inside the reserves could occur where the design for removal of timber can accommodate a low level of ground disturbance. For regeneration-type harvests, the Reserves would need to be at least this wide in order to provide adequate protection.

North of Hwy. 42 the sensitive areas are the steep draws facing the highway west of the lower Sandy Creek compartment and the Frenchie Creek drainage. On these areas we should maintain minimum reserve widths of 100 to 125 feet, but allow commercial thinning to occur within them.

Belieu Creek Drainage- The soil types of concern are the 14F, 46E&F, and 53D&E. These have the potential for sediment delivery either from surface erosion or slide delivery. For regeneration type of harvesting, Reserves of 100-120 ft. from the streams should provide adequate protection. For other activities, reserve widths of 50 -75 ft. on each side of the stream should be adequate, and activities within them could be allowed - providing they were low site disturbance in nature.

Sandy Creek (Lower Sandy Compartment)- The eastern portion of the compartment is likely to produce slides and thus sediment. The upper headwall areas are steeper on the east side of the main creek and are subject to shallow rapid debris flows. Generally, Reserves should be wider in the headwalls than on the lower, gentler slopes. The steep slopes of the 46F soil type on the westside of the creek are also prone to debris flows and reserve boundaries should be approximately 100 -120 ft. from the creeks. The small corner of the Tyee formation is defined by a steep cliff that runs up into the middle and upper Sandy compartments. The Reserves on the 15F and 58F soil types in the northeast corner of the compartment should be left at the interim width of 220 ft. per side until further on site analysis can be accomplished at the project scale. Silvicultural activities within all the Sandy Creek compartment Reserves could be allowed, providing they were low site disturbance in nature.

Middle Sandy Compartment- The troublesome areas are on the eastern portion of the compartment in the LSR area and the top of the ridge that separates the lower and middle Sandy compartments. These areas are TPCC withdrawn due to fragile gradient reasons. The intermittent draws on soil types 15F and 58F in these areas that are not withdrawn should have a 150-220 ft. wide Reserve on each side.

Upper Sandy Compartment- Intermittent streams in areas with FGR TPCC designations on 15F and 58F soil types should have at least a 150 ft. wide Reserve on each side. Other areas within this compartment have gentler slopes, but still have potential to produce sediment. Within these areas, the 4D and 4E soil types are the most common. The Riparian Reserves on these soils should be from 75 - 125 ft. wide per side, depending on the presence of seeps or wet areas. Because the slope changes in a benchy manner on these soil types, there is a tendency to produce small ponds that require protection during harvest activities.

CONCLUSION

Modification of interim Riparian Reserve boundaries should be based on the most restrictive of the preceding guidelines, and based on the findings from field reconnaissance. For example: If the ID Team is evaluating a stream channel on the western side of the Slide Creek Drainage, where site inspection and GIS mapping indicates intermittent flow only, but a seep occurs 100' from the channel, the Riparian Reserve boundary would be drawn at least 100' from the stream with a bubble around the seep area sufficient to maintain the characteristics of the site.

Modification of interim Riparian Reserve boundaries should be tracked in a GIS database.

The predictive tools and models used to determine the boundaries of intermittent stream channels, and field reviews using observed physical or biological indicators to delineate these channels need to be verified through monitoring. A sample of intermittent channels should be visited in September-October to determine the presence or absence of stream flow and key supporting macroinvertebrates. Flow recession analysis needs to be completed to ensure low flows of the season fall within the 80% flow duration, based on the years of record. This information will help adjust and build the stream delineation methods for intermittent streams.

IV RECOMMENDATIONS

FOREST MANAGEMENT

Potential Thinning & Regeneration Harvest Areas

Identify areas of timber harvest needed to meet the District's probable sale quantity (PSQ) commitment.

The following analysis was used to identify general areas of harvest, leaving the specifics such as selection of logging systems, specific unit prescriptions and final unit boundaries to be addressed through the NEPA process.

The first step in the selection process of potential harvest areas was the development a GIS map of all available stands. The map identified areas only within GFMA designated lands; which were greater than 30 years of age; and not located within Riparian Reserve, "Withdrawn" Timber Production Capability Classification allocated lands, or other administratively withdrawn areas.

This first step identified 302 acres of potential thinning based upon stands which are between 30 and 60 years of age. In order to concentrate on areas which are economically or physically feasible to harvest, only areas 10 acres or larger in size were mapped.

This step also identified 1547 acres of potential regeneration harvest based upon stands which were greater than 60 years of age and, again, areas 10 acres or larger in size were mapped. Recommendations used to identify the potential regeneration harvest areas were:

- Concentrate areas of harvest to avoid further fragmentation of the landscape. Harvest units and roads should not be placed within the interior of relatively large, contiguous late successional habitat blocks. If part of a late-successional habitat block must be modified, treatment units should be selected on the edge of the block and designed to minimize fragmentation, to maintain the largest block of habitat intact, and to avoid breaking an otherwise contiguous stand into two stands. (See Section III.6 - subsection Landscape Pattern)

- Maintain connections between key late-successional forest patches. Key late-successional forest areas are those near the Sandy Creek and Kincheloe/Slide Creek LSRs, the areas identified in Figure III.8-9 which allow connections to adjacent watersheds, and the area in T.29 S., R.10 W., Section 33 (See Section III.6 - subsections Landscape Pattern , Bald Eagle; and Section III.8 - Riparian Reserve Evaluation).

- Maintain late-successional forests adjacent to LSR and MMR blocks. While 73% of these Reserve blocks contain stands 80 years and older, almost half (45%) of this is composed of stands in the 80 to 120 year age classes. Stands adjacent to these blocks which were 120 years or older should be considered last for regeneration harvest in order to bolster the function of these LSR and MMR blocks. These stands would enhance the function of the LSR and MMR blocks, while the younger (80 - 120 yr stands) matured towards the more optimal 120 + age class. (See Section III.6 -, subsection Landscape Pattern)

C Concentrate the timing of harvest activities to more closely emulate patterns of infrequent natural disturbance. Remove the portion of the decadal PSQ commitment attributable to the analysis area within a few years, rather than a gradual harvest schedule throughout the decade. (See Section III.5 - Vegetation and III.6 Terrestrial Habitat)

C Establish stocking levels and forest patterns early in each stand's development through planting and pre-commercial thinning treatments. Planting and thinning prescriptions should consider natural stand spacing variations and species composition. The objective is to minimize impacts to wildlife species using the growing stand by reducing the number of silvicultural treatments and harvest entries conducted prior to final harvest. (See Section III.6 -Terrestrial Habitat and Terrestrial Species)

Potential harvest areas (Figure IV-1) were prioritized as to which areas to harvest first. It was understood that commercial thinning areas would receive first priority for treatment depending upon results from subsequent field surveys. These surveys would identify actual tree stocking density and what silvicultural prescription, if any, should be used. Regeneration harvest areas were categorized as a harvest priority 1, 2, or 3, based upon the following definitions:

Priority 1: First priority for harvest. Harvesting of these units would have the least adverse impacts to the criteria above. These areas were generally concentrated or located on forest edges to minimize further landscape fragmentation. These areas were located away from LSR or MMR blocks in order to maintain important late-successional habitat which was supporting nearby LSR or MMRs. Important refugia and connecting habitats were left intact.

Priority 2: Second priority for harvest. Harvesting of these units would have some adverse impacts to the criteria above. These areas had higher fragmenting effects or were close enough to LSR or MMRs to possibly lend late-successional habitat support to the nearby LSR or MMR.

Priority 3: Last priority for harvest. Harvesting of these units would have the most impacts to the criteria above. Regeneration harvesting these areas would fragment existing stands, break important habitat connections, or remove important late-successional habitat near LSRs or MMRs. Deferring regeneration harvest was important on some of these areas in order to protect the oldest stand in the 5th field watershed and to maintain options for future land use allocation changes which could better protect late-successional forest species.

regen harvest map

Maintain and/or restore the abundance, quality and distribution of important habitat features at the site specific, subwatershed and landscape levels, to support dependent wildlife species.

- During commercial thinning, encourage development of more complex canopies on appropriate sites (typically north and east aspects, lower slopes and riparian zones).

- During commercial thinning, retain the natural species mix, including hardwoods, except where past management actions have greatly modified the species mix for the site.

Snags

- On GFMA lands, accelerate the time it would take to obtain snag density goals by managing for >40% population potential on harvest units when possible and/or by creating snags in other suitable areas not yet scheduled for harvest. Forty percent population potential equates to approximately 2 hard snags/acre. Snags should represent a variety of decay classes, topographic positions, seral stages, and distributions (i.e. large and small clumps and singly) and need to be provided through time. (See Section III.6 - Terrestrial Habitat; and Table C-5 in Appendix C)

- On Reserve land allocations, actively strive to meet snag density goals by creating snags in areas currently deficient. Forested reserve areas should be managed for 100% population potential which equates to approximately 6 hard snags/acre. Snags should represent a variety of decay classes, topographic positions, seral stages, and distributions (i.e. large and small clumps and singly) and need to be provided through time. (See Section III.6 - Terrestrial Habitat; and Table C-6 in Appendix C)

- During pre-commercial thinning treatments, consider creating 1 small snag per acre in areas dominated by early and mid-seral stands which contain few snags.

Down Logs

- On GFMA lands, accelerate the time it would take to obtain down log retention goals by exceeding minimum requirements in harvest units and/or by creating down log habitat in areas not yet scheduled for harvest. Minimum retention levels from the RMP (120' of 16" diameter logs) equate to approximately 167 ft^3/ac of hard logs. Existing class 1 and 2 down logs can be removed in harvest units if > 1243 ft^3/ac (approximately 890' of 16" diameter logs) exists in all decay classes in the unit (the low end of availability in natural mature stands based on Spies et al. [1988]). Salvage of down logs in GFMA land will be pursuant to District Policy OR-120-96-05. (See Section III.6 - subsection Terrestrial Habitat)

- On Riparian Reserve lands, actively strive to provide down log levels within the range of natural variability for Oregon Coast Range riparian areas. Target down log levels for all decay classes should be 3587-9475 ft^3/ac (approximately 2569-6786 ft of 16" diameter logs) based on Ursitti (1991). Removal of down logs for salvage or redistribution could be considered if down log availability exceeds 9475 ft^3/ac (approximately 6786 ft of 16" diameter logs) as measured in the disturbance (e.g. blowdown) patch plus a one tree height buffer around the patch (in the Riparian Reserve only). Down logs should represent a variety of decay classes, topographic positions, and orientations and need to be provided through time. (See Section III.6 - Species and Habitat)

- On upland Reserve lands, actively strive to provide down log levels within the range of natural variability for Oregon Coast Range forests. Target down log levels for all decay classes should be 1243-2358 ft^3/ac (approximately 890-1689 ft of 16" diameter logs). Removal of down logs for salvage or redistribution could be considered if down log availability exceeds 2358 ft^3/ac (approximately 1689 ft of 16" diameter logs) as measured in the disturbance (e.g. blowdown) patch plus a one tree height buffer around the patch. Down logs should represent a variety of decay classes, topographic positions, and orientations and need to be provided through time. (See Section III.6 - subsection Terrestrial Habitat)

Prevent disturbances to nesting wildlife.

- In order to insure compliance with the Migratory Bird Treaty Act, the Oregon State Office or higher level should develop recommendations for compliance with the Act regarding timber harvest and other activities which could potentially destroy nests of band-tailed pigeons and other migratory birds.

- Survey cliffs, especially those identified in Figure III.6-1, for nesting falcons if potentially disturbing activities would occur 1 Jan - 31 Aug. Avoid disturbance to peregrine falcons if located (see section III.6 - subsection Terrestrial Species).

Other Silvicultural Activities

Maintain and/or restore canopy complexity to early and mid-seral plantations. (See Section III.6 - subsection Terrestrial Habitat; Section III.5 - Vegetation)

- During precommercial thinning and manual maintenance, encourage development of more complex canopies on appropriate sites (typically north and east aspects, lower slopes and riparian zones).

- Retain the natural species mix within regenerating plantations except where past management actions have greatly modified the species mix for the site.

- Survey for opportunities and use prescribed fire as a tool to restore key habitat components and provide variation in stand level vegetation patterns in Reserve areas.

- During pre-commercial thinning treatments, consider creating 1 small snag per acre in areas dominated by early and mid-seral stands which contain few snags.

- Low disturbance silvicultural activities (i.e. thinnings, maintenance, fertilization) could be allowed in Riparian Reserves providing appropriate buffer areas are left to protect water quality and other ACS objectives..

RESTORATION

Aquatic and In-stream

Maintain and/or restore stream structure, aquatic habitat complexity, and water quality and quantity.

- Conduct aquatic habitat inventories on Anderson, Belieu, Frenchie and Tanner Creeks, using the ODFW method (Moore, et. al. 1993) (see Section III.6 - subsection Aquatic and Riparian Habitat).

- The mainstem Middle Fork Coquille River (Secs. 29 & 30, T.29 S., R.10 W.), Slide Creek (Sec. 33, T.29 S., R.10 W.), and Sandy Creek (Secs. 1 & 2, T.29 S., R.10 W.) are potential candidates for a tree lining project due to the availability of large conifer trees in the adjacent riparian area (Figure III.8-6). Aquatic and riparian habitat within this reach should be further inventoried and evaluated to determine habitat conditions and project feasibility. The channel size and shape, and high stream flows and velocities in this reach require the use of very large and naturally stable structure, some of which may be obtainable from the adjacent forest stand (see Section III.6 - subsection Aquatic and Riparian Habitat; Section III.5 - subsection Riparian Vegetation).

- The lower mile of Belieu Creek (private ownership) is a good candidate for aquatic and riparian habitat enhancement/restoration projects including placement of large wood and boulders, riparian silviculture, and road improvement. Since 75% of the fish bearing reaches are located on private lands, this and other such projects would need to be coordinated with cooperative landowners, ODFW, and watershed associations (see Section III.6 - subsection Aquatic and Riparian Habitat).

General Prescriptions

- Meet or exceed the ODFW (1994) criteria for "good" habitat with respect to all parameters in all fish-bearing reaches, as verified by aquatic habitat surveys (see Section III.6 - subsection Aquatic and Riparian Habitat).

- Select in-stream project sites with the assistance of a hydrologist. Use the Rosgen (1994) stream classification system and Rosgen and Fittante's (1986) suitability guidelines for selecting and evaluating in-stream fish habitat improvement projects to ensure that they are appropriately matched to habitat sites based on stream and valley form characteristics. For example, where F-type stream channels occur in the area (severe channel entrenchment), be aware that channel widening may occur as a result of in-stream projects (see Section III.3 - Stream Channel).

- Where in-stream habitat projects are proposed, use techniques which emulate the habitat complexity found in streams maintained by natural processes. Design structures to mimic the complex aggregations of wood and rock typical of unmanaged coast range streams, facilitate trapping of additional materials, and be self maintaining. Boulder weirs, without the incorporation of large and small woody material, often do not provide over wintering habitat for juvenile salmonids. Large conifer logs should be incorporated into the design and configuration of existing or future boulder weirs, boulder clusters, or boulder/log jams. Use large boulders as anchors/wedges to secure logs in place. Structures should resemble the remnants of a debris torrent and other naturally occurring jams (see Section III.6 - subsection Aquatic and Riparian Habitat).

- C Focus restoration projects in step/pool and pool/riffle stream types (generally Type B and C channels), where they do not meet the desired trend. This may include gradient control log/rock steps to create pools, and placement of whole trees or logs and other log/rock structures to aid in floodplain connectivity, and aid near surface groundwater recharge. Consider tree lining/cutting projects where an abundance of large conifer trees exists. At each site, select a large live conifer tree that can serve as a "key" spanner log, and one or more additional live conifers to be incorporated at various angles with the key piece. Where possible, logs should be 2 to 3 times the width of the active channel, with root wad attached. This will provide different obstruction angles for high stream flows to interact with streambanks and floodplains. Additional hardwood trees could be added to the accumulation to contribute twigs, branches, and additional edges (see Section III.3 - Stream Channel; Section III.6 - subsection Aquatic and Riparian Habitat).

- C For all projects involving large wood, avoid placing cut logs of lengths less than 2 to 3 times the active channel width in the stream channel. If smaller logs are selected, expect these logs to be floated downstream. If anchoring logs at a site is necessary, it should be done with large boulders or more stable logs to minimize the use of steel cable (see Section III.6 - subsection Aquatic and Riparian Habitat).

- C Retain all log jams unless there is compelling risk of damage to the environment or property. An interdisciplinary team (ID) including a hydrologist should review all log/debris jam removal proposals to evaluate both ecological effects and risks to adjacent landowners. This ID team should consider ways to modify the log jam without total removal to meet desired habitat objectives, while assessing the risks to adjacent private property and fish passage (see Section III.6 - Species and Habitat).

- C Determine if additional water needs to be stored in the stream channels in order to augment low flows (see Section III.4 - Water Quality).

- C Protect existing beaver areas and explore opportunities for reestablishing beaver, especially in Sandy Creek (see Section III.3. - Stream Channel; Section III.5 - subsection Riparian Vegetation; Section III.6 - subsection Aquatic and Riparian Habitat).

Human-caused barriers and impediments to fish passage should be removed or modified to allow the native fish species access to their historic range.

- C Belieu Creek above and below the Highway 101 culvert should be surveyed for anadromous fish presence from October (for chinook and coho) through March (for steelhead and lamprey). The culvert should be assessed to determine if it prevents or severely limits fish passage. If so, the culvert should be retrofitted with baffles, weirs, or other structures to facilitate passage of all species of adult and juvenile salmon present in the watershed. Follow-up spawning and juvenile surveys should be conducted to determine success of the project.

- Further assess the costs and benefits of improving steelhead passage into Frenchie Creek. If completed, approximately 0.5 miles of habitat would be made accessible to steelhead. The culvert is located on BLM land within the Hwy. 101 right-of-way. It is necessary to weigh the costs of construction, against the potential benefits of obtaining passage. The close proximity of the culvert outlet to the mainstem Middle Fork Coquille River, and the gradient below the outlet may require construction of a steep pass. Other lower cost alternatives, such as boulder jump pools, may be feasible and more cost effective.

Riparian

Identify and conserve the most intact riparian areas within the watershed to support late-successional, riparian, and aquatic species (see Section III.5 - Vegetation)**.**

- Evaluate stands $\geq$ 160 yrs. old (Figure III.8-6) and other potential reference sites (e.g., a bigleaf maple flat, located in the riparian area in Sec. 2, T.29 S., R.10 W.) through field examinations to determine if they are suitable reference sites, refugia or both. Although reference sites may not necessarily be pristine, they may be studied to discern historical conditions, functions, and process rates. If relatively pristine, they may act as refugia for organisms which have suffered as a result of human disturbances throughout the rest of the watershed.

- Use information gained from reference stands to replicate approximate stand conditions across the landscape. Develop plant association guides which may assist in determining potential natural communities for enhancement areas.

In areas that have been severely altered by management, use silvicultural techniques to enhance natural vegetation patterns, and restore (to potential natural communities and to the extent possible) historic vegetation assemblages and other critical system components (i.e., natural hydrologic function, bank stability, water quality, and native fish and wildlife habitat) (see Section III.5 - Vegetation)**.**

- Silvicultural treatments should be used to spatially link the most intact riparian stands (Figure III.8-6), and other known reference areas.

- Conduct riparian vegetation and riparian habitat inventories in Anderson, Belieu, Frenchie, and Slide Creek drainages to locate potential restoration areas.

- Use early aerial photos that show the pre-management condition (relative abundance of hardwood and conifer), and intact riparian zones as reference stands when developing riparian regeneration and conifer release projects. Select reference stands with similar topographic features, aspect, elevation, and a similar compliment of plant associations. The best reference stand is an intact riparian stand next to the proposed project. Notes from a single reference stand can be used for several projects. Depending on past management, there may be situations where relevant reference stands are unavailable.

- Encourage cooperative riparian restoration efforts between BLM, ODFW, watershed associations, and private land owners. The 1994 BLM riparian survey indicated numerous restoration opportunities on private land, especially in the lower 3 miles of Sandy creek, lower Belieu Creek, and on the mainstem Middle Fork Coquille River.

- In lowland riparian areas, silvicultural treatments should achieve a mixed hardwood stand, with scattered conifers, extending on both sides of the stream to the edge of the floodplains and flood prone terraces. This vegetation should form a canopy over the stream channel with an average of ≥ 60% crown closure over the Middle Fork Coquille River and ≥75% crown closure over Sandy Creek. The understory should include native shrubs and herbaceous species.

- In upland riparian sites, silvicultural treatments should achieve a conifer-dominated overstory (>70% conifer) or conifer/hardwood overstory (30-70% conifer). The range of conditions depends on site conditions, reference stand conditions, and ability to meet specific wildlife and fisheries' objectives. This vegetation should eventually form an average of 75% canopy cover over the stream channel. On BLM lands, this vegetation would extend on both sides of the stream in accordance with the riparian reserve widths specified in the ROD (1994), as modified in accordance with a riparian reserve evaluation (Section III.8 - Riparian Reserve Evaluation). On private lands, this vegetation would extend on either side of the stream channel in accordance with the State Forest Practice Rules (1994). The understory would include a mixture of native shrub species, varying with site conditions.

<u>General Prescriptions</u>

- Hardwood dominated sites (including red alder sites), where they would naturally occur, should not be considered for silvicultural treatments (i.e., active floodplains, unstable slopes, rocky headwalls, and areas with frequent intervals of debris torrents, and other unique geologic sites). Consider the function of the alder and brush as debris racks and sediment filters during floods, as a source of litter input, and as stream shade.

- Where hardwood densities are planned for reduction, 10-30% of the trees should be girdled rather than cut and removed, to provide short-term snag and down log habitat values. Under certain conditions this may not be feasible due to safety concerns or the small diameter of trees being treated. Survey riparian alder habitats scheduled for treatments for white-footed voles to better ascertain impacts to that species.

- Sites in which the occurrence of stand/patch replacing disturbances is greater than 80 years are more logical candidates for conifer reestablishment.

- High gradient streams capable of debris torrents and dominated by red alder (associated with past management disturbance) should be considered for silvicultural treatments. Treatments should be at least within one to one and a half site potential tree width from the stream channel, but may extend upslope according to other vegetation and wildlife objectives.

- Mature, single-stemmed myrtles and bigleaf maples should seldom be removed, especially in lowland riparian areas. Their presence may indicate they occupied a given site historically. However, the presence of conifer stumps in hardwood stands may indicate the historical presence of conifers.

- C In stands where field or aerial photo investigations indicated a conifer-dominated stand was converted to a stand dominated by a mixture of hardwoods, small patches of hardwood could be removed to create gaps in the canopy. Conifers can then be planted, provided the gaps allow adequate sunlight for survival and growth of the conifers.

- C Alder conversion projects in riparian zones need to consider snag and down log retention/creation; placement of cut material into the stream for structure or hiding cover; control of streambank erosion and fine sedimentation by maintaining live root mass along the stream bank; and maintenance of shade over the stream to moderate water temperature.

- C A buffer should be left along the stream to provide shade, bank stability, anchor points for mobile woody debris, and refugia for organisms which may be displaced by management activities. The stability of a site should never be jeopardized to establish conifers.

- C On unstable lower slopes, release of bigleaf maples and conifers, particularly western redcedar, is desirable. Planting of western redcedar or bigleaf maple on a small scale may be worthwhile where there are no other options for obtaining course woody debris over very long reaches. Planting should be considered experimental for now. The probability of converting these sites to conifer by planting is low on sites with active soil movement. Leaving these sites in native shrub, and/or alder will retain shrub and hardwood habitats on appropriate sites.

- C Appropriate consideration must be given to follow-up maintenance of project sites, often each year for 3-5 years following initial treatment. Some sites may require multiple treatments to allow for recovery.

Terrestrial (refer to recommendations for snags and down logs in the Forest Management subsection of Recommendations)

Watershed (General)

Minimize human disturbance to wildlife species of concern (See Section III.6 Terrestrial Species).

- C Minimize construction of additional permanent roads, and when possible close temporary roads immediately following completion of logging and/or planting (see section III.6 - subsection Terrestrial Species).

- C Survey cliffs, especially those identified in Figure III.6-1, for nesting falcons if potentially disturbing activities would occur 1 Jan - 31 Aug. Avoid disturbance to peregrine falcons if located (see section III.6 - subsection Terrestrial Species).

Improve late-successional forest habitat function in and around LSRs.

- Defer harvest of late-successional forests in T29S-R10W-Sec. 1 until consideration is given through the RMP amendment process to designating Section 1 as LSR to provide long-term protection for one of the few remaining old growth habitat stands in the Middle Fork Coquille watershed. Similar acreage of LSR land could be converted to GFMA in T29S-R10W- sections 23, 11, and part of 12 to balance LSR acres.

- Defer harvest in T29S-R10W-Sec. 33 until consideration is given through the RMP amendment process to designating it as LSR to provide nesting options for eagles.

Provide forage opportunities for wildlife where appropriate.

- Consider seeding harvest units with grasses and forbs for big game forage pursuant to the District's Native Seed Policy.

Provide roosting opportunities for bats where appropriate.

- Install bat boxes on BLM-controlled bridges to provide roosting habitat for bats (see section III.6 - subsection Terrestrial Species).

Control the spread and reduce the level of noxious weeds in the analysis area.

General guidelines for the management of noxious weeds are addressed in the *Noxious Weed Strategy for Oregon/Washington 1994, Partners Against Weeds; An Action Plan for the BLM 1996, and Coos Bay District's Weeds Prevention Strategy 1996*. More specifically,
:

- Conduct extensive field inventory of noxious weed locations.

- As mentioned in *Partners Against Weeds; An Action Plan for the BLM 1996,* work with adjacent landowners to create an awareness of the issues surrounding noxious weeds and the consequences of not removing them. Having all landowners aware of the problem will better address noxious weed concerns.

- Since most noxious weeds occur along roads, road building and maintenance equipment should be cleaned using steam or other methods prior to entering or leaving. Logging equipment should also be cleaned in a similar manner.

- Monitor the results of control measures by conducting spot checks to determine effectiveness of removal and control and follow-up treatments.

Reduce the spread and help prevent introduction of Port-Orford-cedar root rot (Phytophthora lateralis) into new areas.

General guidelines for the management of *Phytophthora lateralis* are addressed in the *BLM Port-Orford Cedar Management Guidelines 1994.* That document recommends the development of site specific plans to prevent the spread of the disease. The following recommendations address these site specific plans:

- Timber sales and service contracts, such as manual maintenance and precommercial thinning, address prevention methods. These contracts address such measures as: removing POC from areas where POC is likely to become easily infected (i.e., along roads and running water), washing vehicles before they proceed into an uninfected area, spacing of POC to reduce root contact (thus reduce spread of the disease), and removing POC within 50 feet of an infected area.

- Within infected areas POC trees will be observed for possible resistence, which can be tested. Once resistence is determined, these trees will be kept and used in developing a higher resistant tree for reintroduction.

- Develop treatment plans to prevent the spread of the disease. Areas found not to be infected will be identified. Plans to prevent introduction of the disease into these areas will be developed. Project monitoring and evaluation will be conducted following plan development and implementation.

Create and maintain a database inventory of disease centers and noxious weed infection sites.

- As an inventory of the watershed is obtained, the infection sites will be identified and recorded. A database exists for some infection sites, along with a monitoring effort, but there is a need to input that data into the GIS database and create a Disease and Noxious Weed theme.

Roads

Reduce erosion from roads caused by culvert failure, outlets, or improper location (See Section III.4 - Water Quality).

- Conduct a thorough culvert inventory of roads. Concentrate on roads in proximity to riparian areas or that contain streams. Replace or repair culverts and outlet erosion with "Jobs-in-the-Woods" program or upcoming timber sales, whichever is applicable. Replacement of culverts has been identified, but is not limited to:

Road System/Area	Recommendation	miles
Frenchie Creek	culvert installation** &replacement	3.2
Slide Creek Rd	culvert replacement	3.7
30-10-5.0	culvert replacement	1.0
Other Sandy Creek rds	culvert installation**	1.0

** several locations along Frenchie Creek Road and in Sandy Creek have been identified to be in need of additional culverts (see TMO recommendations for specific roads).

- As part of the inventory process, examine evidence of erosion in ditch lines and current culvert spacing. Identify stable locations for additional culverts needed to reduce ditch line erosion or to decrease ditch line length entering streams.

- Use culverts made of polypropylene material when replacing culverts where possible as culverts associated with running water appear to be rusting through at the contact point.

- C Due to the high erodibility of soil types 14F and 46F, any culvert outlet within these soils should not be 'shotgunned' and stream culverts should be placed on the original stream gradient. Add energy dissipaters at all outlets, unless natural ground conditions prevent erosion. Road fills over the large (i.e., 48") culverts should be armor-plated to reduce erosion of the fill.

- C Prior to construction or replacement of existing culverts, stream inventories should be conducted to determine potential impacts to aquatic amphibians. Where appropriate and possible, facilitate upstream movement of aquatic amphibians through new culverts. (See Section III.6- Terrestrial Species)

Reduce erosion from open roads caused by surface runoff or lack of maintenance (See Section III.4-Water Quality).

- C Consider constructing waterdips or "flavels" on short, low traffic volume roads. Special consideration should be given to their location on highly erodible soil types such as 14F or 46F. Opportunities for such work can occur as part of timber sale final road maintenance or part of normal scheduled maintenance.

- C Naturally surfaced roads should be rocked at perennial streams crossings sufficiently to reduce runoff from the road surface.

- C On roads where the TMO 'slope instability' or 'stream sediment potential' data field is "High", conduct annual maintenance inspections for erosion. Target these roads for corrective reconstruction or maintenance upgrade necessary to reduce the "High" classification.

- C Cooperate with willing landowners and Watershed Associations to identify sediment sources from roads and to plan restoration actions.

Close roads identified through the TMO process to reduce their effect on erosion, water quality, and terrestrial wildlife (See Section III.6 - subsections Terrestrial Habitat, and Road Density).

- C The TMO process identified approximately 9 miles of road to close which could be closed through "Jobs-in-the-Woods" programs or upcoming timber sales, whichever is applicable. TMOs for individual roads to be closed are located in Appendix D-2. Generally, proposed road closures can be summarized as follows:

Road System/Area	Recommendation	BLM miles	method
Frenchie Creek	closure	3.84	gate @ Hwy 42
Sandy Creek	closure	1.64	permanent barriers
Sandy Creek	closure	1.5	gate on -23.0
other area N.Hwy 42	closure	0.25	self close
Slide Creek area	closure	2.3	self close

Installation of physical barriers on the 6.98 miles north of Highway 42 will result in a BLM open road density of 2.62 mi./sq.mi. for that part of the analysis area. The eventual closing of roads in the Slide Creek area would result in a BLM open road density of 1.96 mi./sq.mi. for the part of the analysis area south of Highway 42 .

C Some roads are recommended to be self closing. These short roads will still allow access for reforestation purposes (planting, release, thinning). However, over time, generally a 10 - 15 year period, the encroaching vegetation would act to prohibit vehicular traffic. Roads recommended to be self closing would not be classified as 'closed' until encroaching vegetation physically prohibited vehicular access.

C All self closing roads and those behind permanent barriers should be placed in a self maintaining condition. These roads will not receive further maintenance, and steps need to be undertaken to minimize possible erosion. Construction of waterbars/dips to relieve water traveling in ditches, and removal of culverts and fills in streams are some of the measures which should help to reduce erosion.

Minimize the effects of road construction in Riparian Reserves (See Section III.6 - Species & Habitat).

C Areas subject to mass wasting (Figure III.8-2) and sensitive soil areas including FGR2 (Figure III.4-1) should be used as guidelines to identify unstable areas in which new road construction should be avoided.

C Avoid fragmentation of remaining refugia areas in the analysis area.

C New road construction in areas on uninfected Port-Orford Cedar should be in compliance with the BLM POC Management Guidelines.

RIPARIAN RESERVE BOUNDARIES

See Section III.8 - Riparian Reserve Evaluation, subsection Area of Potential Opportunity for Modification of Interim Riparian Reserves.

DATA GAPS AND LIMITATIONS OF THE ANALYSIS

C Baseline information on most wildlife and fish species abundance, distribution, and habitat associations are lacking; this limits the ability to assess population trends and effects of management.

- C Baseline information on current vegetation and habitat features (e.g. snags) is lacking; this limits the ability to quantify wildlife habitats and to calculate landscape parameters such as fragmentation indices.

- C See Table C-5, Appendix C for a discussion of limitations of the Snag Recruitment Simulator model.

- C With respect to fish populations, the role of Sandy-Remote within the larger 5th field watershed (Middle Fork Coquille River) could not be quantified due to limited adult and juvenile salmonid population data, and highly variable ocean conditions. This limits the ability to determine short-term and long-term population trends.

MONITORING

- C Separate monitoring plans (i.e., wildlife; aquatic/stream channel) which address habitat components, species, physical features, and projects have been developed or are in development. See the separate monitoring plans for further recommendations on monitoring needs.

- C Consider establishing a water quality monitoring trend station in one of the small watersheds in the analysis area. At a minimum, measure flow and turbidity continuously. Take periodic event driven suspended and bedload sediment samples, to see if a correlation can be established with turbidity.

- C Due to the high level of sediment delivery to Sandy Creek, it is of interest to determine sediment trends in this watershed. This may be accomplished by sampling stream bed substrates in depositional stream types, where stream gradients are less than 4%. A sampling scheme may concentrate on high value fish spawning riffle habitats.

- C Establish permanent channel cross section monitoring sites to determine channel stability and evaluate changes in channel morphology (width and depth).

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